NEWARK BAY STUDY AREA

ADDITIONAL SITES AND CANDIDATE PRPS FOR THE NEWARK BAY STUDY AREA

VOLUME II OF VI

PRP DATA EXTRACTION FORM AND EVIDENCE CONCERNING:

EXXON MOBIL CORPORATION
BAYWAY REFINERY SITE

PREPARED BY:
TIERRA SOLUTIONS, INC.

SUBMITTED TO:
USEPA REGION II

MAY 2007

40

Trademarks > Trademark Electronic Search System(Tess)

TESS was last updated on Wed Mar 21 04:21:22 EDT 2007

Record 93 out of 93

Word Mark	CONOCO
Goods and Services	IC 005. US 015. G & S: GASOLINE, [MOTOR-FUEL OILS, NAPHTHA, KEROSENE, DISTILLATE FOR BURNING IN INTERNAL-COMBUSTION ENGINES, GAS OIL, FURNACE-FUEL OILS,] LUBRICATING OILS, [PETROLEUM] GREASES [AND ROAD DRESSING OIL]. FIRST USE: 19290615. FIRST USE IN COMMERCE: 19290615
Mark Drawing Code	(3) DESIGN PLUS WORDS, LETTERS, AND/OR NUMBERS
Design Search Code	26.05.20 - Triangles inside one another 26.05.21 - Triangles that are completely or partially shaded 26.11.21 - Rectangles that are completely or partially shaded
Serial Number	71287524
Filing Date	July 23, 1929
Current Filing Basis	1A
Original Filing Basis	1A
Registration Number	0270389
Registration Date	May 6, 1930
Owner	(REGISTRANT) CONTINENTAL OIL COMPANY CORPORATION DELAWARE 50 BROADWAY NEW YORK NEW YORK (LAST LISTED OWNER) CONOCO INC. CORPORATION BY CHANGE OF NAME FROM DELAWARE PO BOX 1267 1000 SOUTH PINE STREET PONCA CITY OKLAHOMA 746021267
Assignment	ASSIGNMENT RECORDED

BBF000054

Recorded	
Attorney of Record	Edward D. Steakley
Prior Registrations	0100102;0186698;0212187
Type of Mark	TRADEMARK
Register	PRINCIPAL
Affidavit Text	SECT 12C. SECT 15. SECTION 8(10-YR) 20001109.
Renewal	4TH RENEWAL 20001109
Live/Dead Indicator	LIVE

TESS HOME | NEW USER | STRUCTURED | FREE FORM | BROWSE DICT | SEARCH OG | TOP | HELP | PREV LIST | CURR LIST | NEXT LIST | FIRST DOC | PREV DOC | NEXT DOC | LAST DOC

| .HOME | SITE INDEX | SEARCH | eBUSINESS | HELP | PRIVACY POLICY

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TOSCO CORPORATION

PRINT

Business Entity Information			
Status:	Merge Dissolved on 12/12/2002	File Date:	9/16/1955
Type:	Domestic Corporation	Corp Number:	C1250-1955
Qualifying State:	NV	List of Officers Due:	9/30/2003
Managed By:		Expiration Date:	

Resident Agent Information			
Name:	.SECRETARY OF STATE	Address 1:	202 N. CARSON ST.
Address 2:		City:	CARSON CITY
State:	NV	Zip Code:	89701-4201
Phone:		Fax:	
Email:		Mailing Address 1:	
Mailing Address 2:		Mailing City:	
Mailing State:		Mailing Zip Code:	

View all business entities under this resident agent

Financial Information			
No Par Share Count:	0	Capital Amount:	$ 0
Par Share Count:	100.00	Par Share Value:	$ 0.01

Officers ||| Include Inactive Officers

Secretary - DALE J BILLAM			
Address 1:	1234 ADAMS BLDG	Address 2:	
City:	BARTLESVILLE	State:	OK
Zip Code:	74004	Country:	
Status:	Active	Email:	

President - D B HOLTHE			
Address 1:	1500 N PRIEST DR	Address 2:	
City:	TEMPE	State:	AZ
Zip Code:	85281	Country:	
Status:	Active	Email:	

Treasurer - J W SHEETS

BBF000055

Address 1:	3 A3 PHILLIPS BLDG	Address 2:	
City:	BARTLESVILLE	State:	OK
Zip Code:	74004	Country:	
Status:	Active	Email:	

Actions\Amendments

Click here to view 46 actions\amendments associated with this company

New Search

Printer Friendly

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TOSCO CORPORATION

Business Entity Information

Status:	Merge Dissolved on 12/12/2002	File Date:	9/16/1955
Type:	Domestic Corporation	Corp Number:	C1250-1955
Qualifying State:	NV	List of Officers Due:	9/30/2003
Managed By:		Expiration Date:	

Resident Agent Information

Name:	.SECRETARY OF STATE	Address 1:	202 N. CARSON ST.
Address 2:		City:	CARSON CITY
State:	NV	Zip Code:	89701-4201
Phone:		Fax:	
Email:		Mailing Address 1:	
Mailing Address 2:		Mailing City:	
Mailing State:		Mailing Zip Code:	

Financial Information

No Par Share Count:	0	Capital Amount:	$ 0
Par Share Count:	100.00	Par Share Value:	$ 0.01

Officers

Include Inactive Officers

Secretary - DALE J BILLAM

Address 1:	1234 ADAMS BLDG	Address 2:	
City:	BARTLESVILLE	State:	OK
Zip Code:	74004	Country:	
Status:	Active	Email:	

President - D B HOLTHE

Address 1:	1500 N PRIEST DR	Address 2:	
City:	TEMPE	State:	AZ
Zip Code:	85281	Country:	
Status:	Active	Email:	

Treasurer - J W SHEETS

Address 1:	3 A3 PHILLIPS BLDG	Address 2:	
City:	BARTLESVILLE	State:	OK
Zip Code:	74004	Country:	
Status:	Active	Email:	

Actions\Amendments

Action Type:	Articles of Incorporation		
Document Number:	C1250-1955-001	# of Pages:	0
File Date:	09/16/1955	Effective Date:	

(No Notes for this action)

Action Type:	Amendment		
Document Number:	C1250-1955-003	# of Pages:	1
File Date:	03/26/1957	Effective Date:	

AMENDING ARTICLE FOURTH MAKING CAPITAL STOCK 2,000,000 @ 15 PER SHARE TOTAL $300,000.00

Action Type:	Amendment		
Document Number:	C1250-1955-004	# of Pages:	1
File Date:	11/13/1957	Effective Date:	

ADDING A NEW ARTICLE "TENTH" RELATIVE TO PREEMTIVE RIGHTS.

Action Type:	Amendment		

Document Number:	C1250-1955-005	# of Pages:	1
File Date:	05/17/1960	Effective Date:	
AMENDMENT INCREASING CAP STOCK TO $450,000.			
Action Type:	Amendment		
Document Number:	C1250-1955-006	# of Pages:	1
File Date:	06/10/1963	Effective Date:	
AMENDING ARTICLE IV AND ELEVEN INCREASING CAPITAL STOCK TO $2,050,000.00			
Action Type:	Amendment		
Document Number:	C1250-1955-007	# of Pages:	1
File Date:	03/07/1967	Effective Date:	
AMENDING ARTICLE IV. INCREASING CAPITAL STOCK TO $3,400,000.00			
Action Type:	Amendment		
Document Number:	C1250-1955-008	# of Pages:	1
File Date:	07/25/1969	Effective Date:	
CERTIFICATE OF AMENDMENT INCREASING CAPITAL STOCK TO $4,000,000			
Action Type:	Amendment		
Document Number:	C1250-1955-009	# of Pages:	1
File Date:	07/13/1971	Effective Date:	
CERTIFICATE OF AMENDMENT INCREASING CAPITAL STOCK TO $4,750,000			
Action Type:	Amendment		
Document Number:	C1250-1955-010	# of Pages:	1
File Date:	11/24/1971	Effective Date:	
RESTATED ARTICLES OF INCORPORATION			
Action Type:	Amendment		
Document Number:	C1250-1955-011	# of Pages:	1
File Date:	06/13/1974	Effective Date:	
CAPITAL STOCK $5,500,000.00			
Action Type:	Resident Agent Change		
Document Number:	C1250-1955-012	# of Pages:	1
File Date:	10/07/1974	Effective Date:	
UNITED STATES CORPORATION CO. 502 E. JOHN - ROOM E			
P. O. BOX 1867 CARSON CITY NV 89701			
Action Type:	Amendment		
Document Number:	C1250-1955-013	# of Pages:	1
File Date:	06/23/1975	Effective Date:	
CERTIFICATE OF AMENDMENT			
Action Type:	Amendment		
Document Number:	C1250-1955-014	# of Pages:	1
File Date:	03/29/1976	Effective Date:	
CERTIFICATE OF DESIGNATION, PREFERENCES AND RELATIVE PARTICIPATING, OPTIONAL			
OR OTHER SPECIAL RIGHTS			
Action Type:	Amendment		
Document Number:	C1250-1955-015	# of Pages:	1
File Date:	07/28/1976	Effective Date:	
ARTICLE I CHANGING NAME TO: TOSCO CORPORATION			
OIL SHALE CORPORATION, THE BN 001			
Action Type:	Merger		
Document Number:	C1250-1955-016	# of Pages:	7
File Date:	02/03/1978	Effective Date:	
CERT. OF OWNERSHIP MERGING LION OIL COMPANY (A DELAWARE CORPORATION) INTO THIS			
CORPORATION			
Action Type:	Amendment		
Document Number:	C1250-1955-017	# of Pages:	1
File Date:	08/29/1979	Effective Date:	
CERTIFICATE OF REDUCTION OF CAPITAL STOCK			

Action Type:	Amendment		
Document Number:	C1250-1955-018	# of Pages:	1
File Date:	04/11/1980	Effective Date:	
ARTICLE VII-DIRECTORS			
Action Type:	Amendment		
Document Number:	C1250-1955-019	# of Pages:	1
File Date:	12/02/1982	Effective Date:	
CERTIFICATE OF DESIGNATIONS			
Action Type:	Amendment		
Document Number:	C1250-1955-020	# of Pages:	1
File Date:	12/13/1983	Effective Date:	
CREATING A SERIES B PREFERRED STOCK			
CREATING A SERIES C PREFERRED STOCK (2ND OF TWO FILINGS)			
Action Type:	Amendment		
Document Number:	C1250-1955-021	# of Pages:	1
File Date:	02/03/1984	Effective Date:	
STOCK WAS $4,750,000. - NOW 71,000,000 COMMON @ .15 AND 1,000,000 @ $1.00			
Action Type:	Amendment		
Document Number:	C1250-1955-022	# of Pages:	1
File Date:	06/05/1984	Effective Date:	
CERTIFICATE OF DESIGNATION OF SERIES D PREFERRED STOCK			
CERTIFICATE OF DESIGNATION			
Action Type:	Amendment		
Document Number:	C1250-1955-023	# of Pages:	1
File Date:	07/09/1986	Effective Date:	
ARTICLE 7 & 12			
Action Type:	Amendment		
Document Number:	C1250-1955-024	# of Pages:	1
File Date:	12/29/1986	Effective Date:	
CERT. OF AMEND OF RESTATED ART. 175,000,000 COMMON @.15&12,000,000 @ $1.OO PREF			
CAPITAL STOCK WAS $12,500,000			
CERTIFICATE OF DESIGNATION, PREFERENCES, AND RELATIVE PARTICIPATING OPTIONAL OR			
OTHER SPECIAL RIGHTS OF $2.375 SEREIS E CONVERTIBLE PREFERRED			
Action Type:	Amendment		
Document Number:	C1250-1955-025	# of Pages:	1
File Date:	04/02/1987	Effective Date:	
CERTIFICATE OF REDUCTION OF SERIES B PREFERRED & SERIES C PREFERRED STOCK			
CERT. OF REDUCTION OF CAPITAL & RETIREMENT OF SERIES A. PREF. (2ND FILING)			
Action Type:	Amendment		
Document Number:	C1250-1955-026	# of Pages:	1
File Date:	07/14/1987	Effective Date:	
ADDING DIRECTORS LIABILITY			
Action Type:	Amendment		
Document Number:	C1250-1955-027	# of Pages:	1
File Date:	12/23/1987	Effective Date:	
CERTIFICATE OF OWNERSHIP: MERGING TOSCO PRODUCTION FINANCE CORPORATION, (A			
DELAWARE CORP.), NOT QUAL. IN NEVADA, INTO THIS CORP...			
Action Type:	Amendment		
Document Number:	C1250-1955-028	# of Pages:	1
File Date:	07/31/1989	Effective Date:	
CAPITAL STOCK WAS 3825000 BJD			
CERTIFICATE OF AMENDMENT OF RESTATED ARTICLES-BALANCE OF STOCK IS 50,000,000			
SHARES COMMON @ .75. BJD			
Action Type:	Amendment		
Document Number:	C1250-1955-029	# of Pages:	1
File Date:	08/07/1991	Effective Date:	

2 SEPARATE CERTIFICATES OF REDUCTION WERE FILED. ONE FOR THE REDUCTION OF $2.375 SERIES E PREFERRED AND ONE FOR THE RETIREMENT OF SERIES D PREFERRED STOCK. DMF			
Action Type:	Amendment		
Document Number:	C1250-1955-030	# of Pages:	1
File Date:	08/14/1991	Effective Date:	
CERTIFICATE OF VOTING POWERS, DESIGNATIONS, PREFERENCES, AND REALATIVE, PARTICIPATING OPTIONAL OR OTHER SPECIAL RIGHTS OF $4.375 SERIES F CUMULATIVE. TLS			
Action Type:	Merger		
Document Number:	C1250-1955-031	# of Pages:	1
File Date:	12/28/1993	Effective Date:	
ARTICLES OF MERGER MERGINGPNW PROPERTIES INC.(A DE. CORP. NOT QUAL. IN NV.) INTO THIS CORPORATION. P T			
Action Type:	Amendment		
Document Number:	C1250-1955-032	# of Pages:	1
File Date:	10/14/1994	Effective Date:	
CERTIFICATE FILED PURSUANT TO NRS 78.207. AUTHORIZED STOCK NOT AFFECTED.(4)PGS DMF			
Action Type:	Amendment		
Document Number:	C1250-1955-033	# of Pages:	1
File Date:	02/14/1997	Effective Date:	
CAPITAL STOCK WAS $49,500,000. DMF AMENDED AND RESTATED ARTICLES FILED AMENDING STOCK. BREAKDOWN OF SHARES: 250 MIL. COMMON @ .75 AND 12 MIL. PREF. @ $1.00. CORPORATION HAS PAID THE MAXIMUM FILING FEE OF $25,000. ANY AMENDMENTS TO INCREASE STOCK FILED IN THE FUTURE ARE ONLY $75.00. (19)PGS. DMF			
Action Type:	Annual List		
Document Number:	C1250-1955-045	# of Pages:	2
File Date:	09/23/1998	Effective Date:	
(No Notes for this action)			
Action Type:	Amendment		
Document Number:	C1250-1955-034	# of Pages:	10
File Date:	12/18/1998	Effective Date:	
CERTIFICATE OF DESIGNATION FILED DESIGNATING 2,500,000 SHARES AS "SERIES A JUNIOR PARTICIPATING PREFERRED STOCK". (10)PGS. MMR			
Action Type:	Annual List		
Document Number:	C1250-1955-046	# of Pages:	1
File Date:	10/11/1999	Effective Date:	
(No Notes for this action)			
Action Type:	Resident Agent Address Change		
Document Number:	C1250-1955-035	# of Pages:	1
File Date:	10/29/1999	Effective Date:	
CORPORATION TRUST COMPANY OF NEVAD KFA ONE EAST FIRST STREET RENO NV 89501 KFA			
Action Type:	Annual List		
Document Number:	C1250-1955-043	# of Pages:	2
File Date:	11/20/2000	Effective Date:	
(No Notes for this action)			
Action Type:	Annual List		
Document Number:	C1250-1955-044	# of Pages:	3
File Date:	09/01/2001	Effective Date:	
(No Notes for this action)			
Action Type:	Amendment		
Document Number:	C1250-1955-036	# of Pages:	1
File Date:	09/14/2001	Effective Date:	

CAPITAL STOCK WAS 250 MIL. COMMON @ $.75 AND 12 MIL. PREF. @ $1.00 =			
$199,500,000. DMF			
Action Type:	Merger		
Document Number:	C1250-1955-037	# of Pages:	1
File Date:	09/14/2001	Effective Date:	
ARTICLES OF MERGER FILED MERGING PING ACQUISITION CORP., A (NV) CORPORATION,			
#2712-01, INTO THIS CORPORATION WITH AMENDED AND RESTATED ARTICLES ATTACHED			
AMENDING RESIDENT AGENT, STOCK AND DIRECTORS AND DELETING ARTICLES. (8)PGS.			
(BREAKDOWN OF SHARES: 100 @ .01 = $.10) DMF			
Action Type:	Resident Agent Change		
Document Number:	C1250-1955-038	# of Pages:	1
File Date:	09/14/2001	Effective Date:	
CORPORATION TRUST COMPANY OF NEVADA			
6100 NEIL ROAD #500 RENO NV 89511 DMF			
Action Type:	Merger		
Document Number:	C1250-1955-039	# of Pages:	6
File Date:	09/28/2001	Effective Date:	
#1 OF 3. ARTICLES OF MERGER FILED MERGING TOSCO HOLDINGS CORP., A (DE)			
CORPORATION NOT QUALIFIED IN NEVADA, INTO THIS CORPORATION. EFF. DATE: 10/1/01			
(2)PGS. DMF			
#2 OF 3. ARTICLES OF MERGER FILED MERGING TOSCO L.P., A (DE) LIMITED PARTNER-			
SHIP NOT REGISTERED IN NEVADA, INTO THIS CORPORATION. EFF. DATE: 10/01/01.			
(2)PGS. DMF			
#3 OF 3. ARTICLES OF MERGER FILED MERGING TOSCO REFINING L.P., A (DE)			
LIMITED PARTNERSHIP NOT REGISTERED IN NEVADA, INTO THIS CORPORATION. EFF. DATE:			
10/01/01. (2)PGS. DMF			
Action Type:	Annual List		
Document Number:	C1250-1955-002	# of Pages:	3
File Date:	09/26/2002	Effective Date:	
List of Officers for 2002 to 2003			
Action Type:	Merger		
Document Number:	C1250-1955-040	# of Pages:	2
File Date:	12/12/2002	Effective Date:	
#1 OF 2 - ARTICLES OF MERGER FILED MERGING TOSCOPETRO CORPORATION, A (DE) CORP.			
NOT QUALIFIED IN NEVADA INTO THIS CORPORATION. EFF. DATE OF 12/31/02.			
(2)PGS. JEP			
Action Type:	Resident Agent Change		
Document Number:	C1250-1955-041	# of Pages:	1
File Date:	12/12/2002	Effective Date:	
CSC SERVICES OF NEVADA, INC. ROOM E			
502 EAST JOHN STREET CARSON CITY NV 89706 JEP			
Action Type:	Merge Out		
Document Number:	C1250-1955-042	# of Pages:	1
File Date:	12/12/2002	Effective Date:	
#2 OF 2 - ARTICLES OF MERGER FILED MERGING THIS CORP. INTO PHILLIPS PETROLEUM			
COMPANY, A (DE) CORPORATION, #C392-1947. NV SECRETARY OF STATE DESIGNATED AS			
AGENT FOR SERVICE OF PROCESS. FORWARDING ADDRESS: 600 N. DAIRY ASHFORD,			
HOUSTON, TX 77079. EFF. DATE OF 1/1/03.			
(2)PGS. JEP			

Shell is a worldwide group of oil, gas and petrochemical companies with interests in biofuels, wind and solar power and hydrogen. We help meet global energy demand in economically, environmentally and socially responsible ways.

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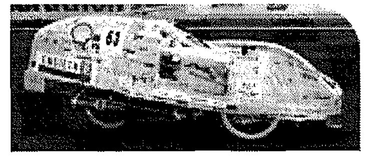
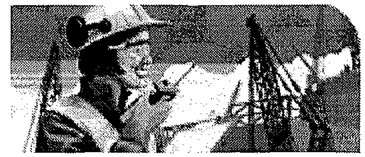


Shell Eco-marathon expands
Shell Eco-marathon in America for the first time.



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Real energy solutions for the real world

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Foundation stone laid for Pearl Gas to Liquids project

Share price

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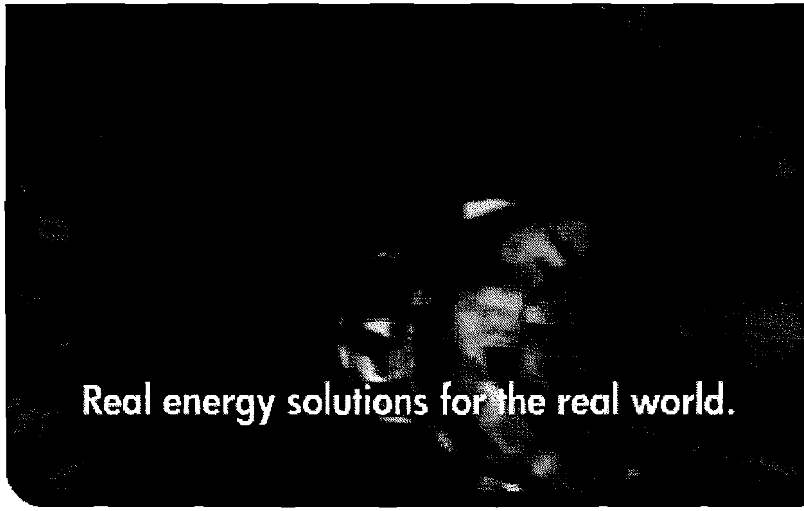
About the Shell Group



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Take the Challenges

At a glance

Who we are, what we do and our performance in short.

Who we are

Discover our vision and values, explore our worldwide operations and get to know Shell's people and history.

What we do

From exploring for oil and gas to developing new energy sources - discover the energy industry and learn why Shell is more than just an oil company.

Our strategy

Find out what our strategy 'more upstream, profitable downstream' is all about and how we bring it alive.

The energy challenge

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Shell Directory

How does Shell approach the global challenge of meeting energy demand while minimising environmental and social effects?

At a glance

Shell is a global group of energy and petrochemical companies. We are active in more than 130 countries and territories and employ 108,000 people worldwide.

We believe that oil and gas will be integral to the global energy needs for economic development for many decades to come. Our role is to ensure that we extract and deliver them profitably and in environmentally and socially responsible ways. Read more in Our Vision.

Our strategy and priorities for the future are "more upstream and profitable downstream." We are focusing on delivery and growth, leveraging our strong portfolio. Read more about our strategy and major projects.

Our core values; honesty, integrity and respect have formed the basis of our General Business Principles for 30 years and remain as important as ever. Read the Shell General Business Principles.

We are convinced that our short- and long-term business success depend on finding environmentally and socially responsible ways to help meet the world's future energy needs. Find out more on our Environment and Society website.

Executive Committee

o Jeroen van der Veer, Chief Executive of Royal Dutch Shell,
o Linda Cook, Executive Director Gas & Power
o Malcolm Brinded, Executive Director Exploration & Production,
o Peter Voser, Chief Financial Officer
o Rob Routs, Executive Director Downstream Oil Products & Chemicals

Find out more in the Leadership section.

For more than 100 years our logo the 'Pecten', the name 'Shell' and our distinctive red and yellow colours have identified the Shell brand and promoted our corporate reputation. Learn about Shell's history.

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Our history

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At a glance
Who we are
- Our vision
- **Our history**
  - The beginnings
  - The early 20th century
  - Post-war expansion
  - 1960s to the 1980s
  - 1980s to the new century
  - History of the Shell logo
- Shell Worldwide
- Leadership
- Our values

What we do
Our strategy
The energy challenge
Real energy stories
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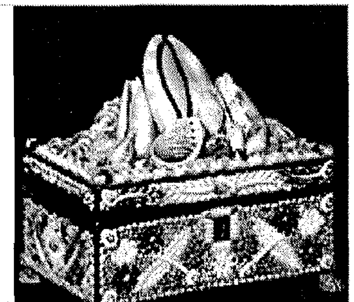
1833
How Shell started

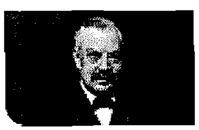
Marcus Samuel, a young shopkeeper selling antiques and bric-a-brac in Londons East End, decided to expand his merchandise to include oriental shells. Shells were hugely popular at this time and the decision transformed his shop into a highly successful import/export business. Little did he realise, in an industrial age powered by coal, this was the foundation for a business that would be at the very heart of the oil industry.



1830 1840 1850 1860 1870 1880 1890 1900 1910

Use the arrows to move the timeline

The beginnings



How the Samuel family business grew from a shop selling sea shells into a rapidly expanding oil company.

The early 20th century

Shell becomes the world's leading oil company and founds Shell Chemicals to advance its refining business.

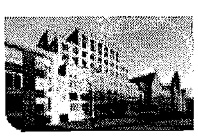
Post-war expansion

Oil demand soars and Shell expands dynamically. The super-tanker is born, Shell extends its exploration overseas and forms a partnership with Ferrari.

1960s to the 1980s

Shell Chemicals enters a golden period of research, produces its General Business Principles and diversifies its staff.

1980s to the new century



Shell grows through acquisition and, in 2005, unifies Royal Dutch and Shell Transport under the title Royal Dutch Shell plc.

History of the Shell logo

For more than 100 years our logo, the Pecten has identified the Shell brand and promoted our corporate reputation.

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The beginnings

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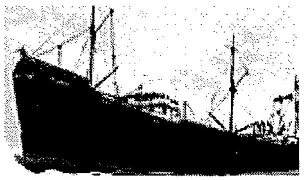
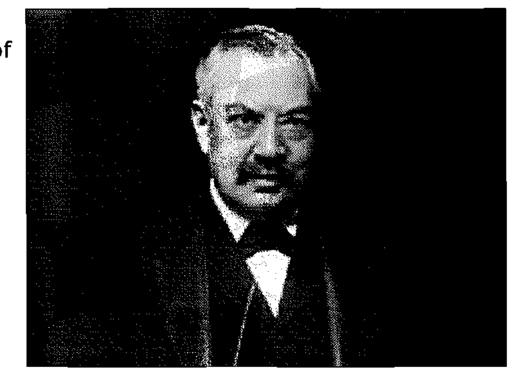


In 1833, shopkeeper, Marcus Samuel, decided to expand his London business. He sold antiques, but now added oriental shells. He aimed to capitalise on a fashion for using them in interior design. His instinct was right - such was the demand that Samuel quickly began importing shells from the Far East, laying the foundations for his import/export business.

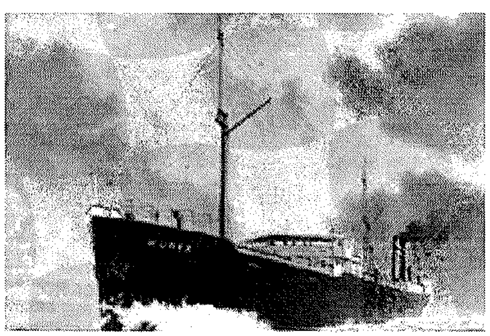
The market for oil remained confined to lighting and lubricants until, in 1886, the internal combustion engine and demand for gasoline arrived with Karl Benz and the first Mercedes. By now the Samuel business had passed to Marcus Samuel junior and his brother Sam. They exported British machinery, textiles and tools to newly industrialising Japan and the Far East and on return imported rice, silk, china and copperware to the Middle East and Europe. In London, they traded in commodities such as sugar, flour and wheat worldwide.



It was during a trip to Japan that Marcus became interested in the oil exporting business then based in Baku, Russia. The Rothschilds had invested heavily in the 1880s in rail and tunnels to overcome the transport difficulties of getting oil from this landlocked base to the Black Sea and from there to overseas markets. Shipping still posed a problem as the oil was carried in barrels, which could leak and took up much space in the ship's hold.

Marcus and Sam commissioned a fleet of steamers to carry oil in bulk, using for the first time the Suez Canal. They also set up bulk oil storage at ports in the Far East and contracted with Bnito, a Russian group of producers controlled by the Rothschilds, for the long-term supply of kerosene. Their strategy was high-risk: if news of their operations got out they would be squeezed out by Rockefeller's dominant Standard Oil. With the maiden voyage of the first bulk tanker, the "Murex", through the Suez Canal in 1892 the Samuels had achieved a revolution in oil transportation. Bulk transport substantially cut the cost of oil by enormously increasing the volume that could be carried. The Samuel brothers initially called their company The Tank Syndicate but in 1897 renamed it the Shell Transport and Trading Company.

Petroleum was also being produced in the East Indies, a Dutch colony, and in 1890 a company had been formed to develop an oilfield in Sumatra. This was the origins of what was to become the Royal Dutch Petroleum Company. Under the management of J.B. August Kessler, they built a pipeline and refinery at Pankalan Brandan. Kessler was joined in 1896 by a dynamic young marketing director, Henry Deterding, who was to become a dominant figure in the company until the outbreak of the Second World War. Faced with the competition from the Samuels' low bulk transport costs, Royal Dutch began the construction of tankers and bulk storage installations and set up its own sales organisation.



By the turn of the century, Marcus Samuel had become the model of an Edwardian plutocrat with a grand house in London and a country mansion, which had been bought lock, stock and barrel with furniture, pictures and parkland from Lord Romney. He kept horses and carriage and was active in public life in the City of London. He was knighted in 1898, became Lord Mayor of London and was a leading figure in the London business community. But Marcus Samuel's dependence on Russian producers left him vulnerable and he decided to seek other sources of oil.

The Far East was the obvious place to look – and his first venture into Borneo brought him up against Royal Dutch Petroleum, one of the region's biggest competitors. The two companies joined forces to protect themselves against the might of Standard Oil, forming a sales organisation in 1903, the Asiatic Petroleum Company. The discovery of oil in Texas offset a series of troubles which had affected both companies.

In 1904, the scallop shell or pecten replaced Shell Transport's first marketing logo, a mussel shell. In various forms it has remained in use ever since, becoming one of the best known corporate symbols in the world.

The full merger of the two companies into the Royal Dutch Shell Group came in 1907. There were two separate holding companies with Royal Dutch taking 60% of earnings and Shell Transport taking 40%. The business was run by a variety of operating companies. The merger transformed the fortunes of both companies. Under the management of Henry Deterding they turned from struggling entities to successful enterprises within twelve months.

The Group rapidly expanded across the world. Marketing companies were formed throughout Europe and in many parts of Asia. Exploration and production began in Russia, Romania, Venezuela, Mexico and the United States.

The first twelve years also provided many exciting opportunities to demonstrate the quality of the products in the new, fast-developing market for gasoline. These included record-breaking races, flights and journeys of exploration. In 1907, Prince Borghese won the Peking to Paris motor rally on Shell motor spirit. The same fuel was used at the Brooklands racing track in the UK. In the Antarctic, Shackleton and Captain Scott used Shell fuel , while Bleriot's inaugural cross-Channel flight was made on Shell spirit.

The early 20th century

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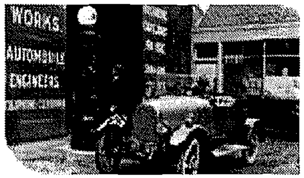
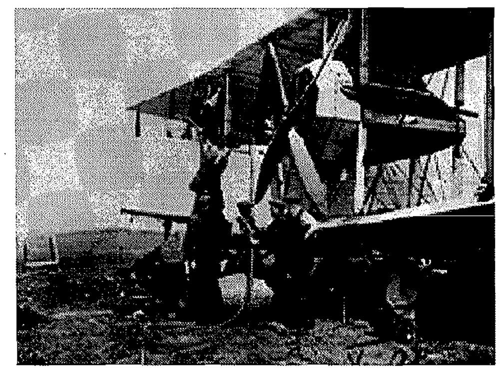


During World War I Shell became the main fuel supplier of the British Expeditionary Force and profited from increased after-war motor car use. By the end of the 1920s Shell was the world's leading oil company and founded Shell Chemicals. The 1930s depression forced Shell to reduce its staff and World War II lead to the destruction of a lot of its properties.

The First World War inevitably brought mixed fortunes for the Group. Shell made a major contribution to the Allies' war effort by becoming the main supplier of fuel to the British Expeditionary Force. It was also the sole supplier of aviation fuel and it provided 80% of the Army's TNT. In addition it volunteered all its shipping to the British Admiralty. Thus it enhanced its reputation and its profits while it continued to develop in parts of the world unaffected by the conflict such as in Venezuela, Mexico and Sarawak. The war confirmed the supremacy of oil-fired transport over the slower and less flexible railway system that the Germans relied on. Less happily, the German invasion of Rumania in 1916 saw 17% of the Group's worldwide production destroyed in a few days, while in Russia the revolution saw all its assets seized.



The post war period began auspiciously when Alcock and Brown used Shell fuel to make the first trans-Atlantic flight in 1919. The inter-war years were a time of rapid expansion for the oil companies as the use of motor cars and demand for gasoline increased. There were huge gains also as major oil fields were discovered in California, South America and the Middle East, notably Iraq and Saudi Arabia. Drilling techniques made huge strides with the use of mud to regulate pressure in oil wells. The refining and downstream businesses also grew rapidly and in 1929, Shell Chemicals was founded to advance the refinement of chemicals from oil.

By the end of the 1920s Shell was the world's leading oil company, producing 11% of the globe's crude oil supply and owning 10% of its tanker tonnage. Its fuel quality was high, it was diversifying its product base and had an assured and prolific supply of oil from the Middle East. But the price of oil proved to be volatile and efforts to control the market by price-cutting or through an informal cartel with other oil majors were doomed to failure.

The 1930s began with the Depression, forcing Shell to reduce its workforce and impose financial cuts. Even the annual sports day at the Lensbury club in London fell victim. But the decade saw many advances: great progress in fuel and chemicals research and an explosion of brilliant advertising with themes of power, purity, reliability, modernity and getting away from it all. Many designs have become classics.

As a mark of confidence, the Group also purchased a large riverside plot on the Thames in London to build ShellMex House, one of the Group's landmark buildings round the world. The ShellMex company handled all the marketing of Shell's products. Part of the growing maturity of the marketing activities was the development of the global network of service stations where cars could refuel. The service stations, with their distinctive appearance, helped build the Group's reputation for reliability and quality.

The 1930s saw oil politicised. Shell's assets in Mexico were seized and to avoid a similar fate in Venezuela it was forced to concede generous terms to the government. In Europe the rise of the Nazis posed a threat to the Group's Dutch assets. With the invasion of Holland after the outbreak of war in 1939, the head offices of the Dutch companies were moved to Curacao. The London office remained open but was dedicated to supporting the British war effort. Properties in Eastern Europe were destroyed, particularly in Germany, and access to Rumania was lost. The US refineries produced aviation fuel to support the Allied air forces. Shell Chemical Corporation produced butadiene for synthetic rubber, a vital commodity. All tankers came under Government control and Shell losses were heavy, totalling 87 ships.

Many Shell staff displayed great bravery in keeping the tankers going and were duly rewarded. Most famous of them was the flying ace Douglas Bader whose inspirational story was told in the film Reach for the Sky. He worked in the Aviation Department of Asiatic Petroleum before joining the RAF in 1939. He returned to Shell after the war, a hero.

Post-war expansion

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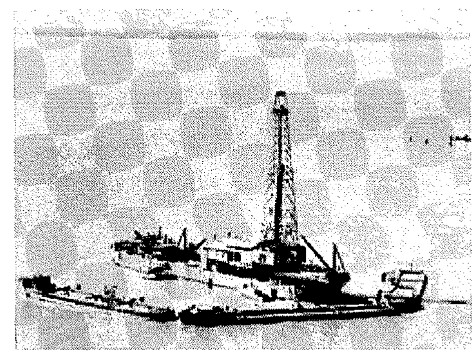
Shell's post-war years were marked by reconstruction and an ambitious expansion programme. Scientific advances and a growing number of cars in the US led to an exploding oil demand. Shell contributed to the invention of the jet engine and in 1950 formed a partnership with Ferrari. In the late 1950s the Group's structure was reorganised.

The immediate post-war years some of the toughest Shell had yet faced. Reconstruction was hugely expensive. But the market for oil was changing rapidly and the group needed a programme of ambitious expansion. New programmes of exploration began in Africa and South America and new refineries were built in the UK. Shipping became larger and better powered so that more bulk could be carried. The supertanker was born.

In 1947, the first commercially viable offshore oil well was drilled in the Gulf of Mexico. Two years later Shell drew its own first subsea oil there. By 1955 Shell had 300 offshore wells, mostly in the Gulf. But there were also new discoveries in the Niger delta and in Borneo. Commercial production of oil in Nigeria began in 1958.

The return of peace brought an explosion in civilian demand for oil products – in particular gasoline in the USA, where the number of cars rose by 60% between 1945 and 1950. To end its supply bottlenecks, Shell formed an alliance with Middle East Gulf Oil, giving it a substantial stake in this increasingly important region.



A number of scientific advances also boosted demand for oil. Shell contributed to the invention of the jet engine - its architect Sir Frank Whittle worked for the Group for a number of years. The 1940s also saw the development of the catalytic cracker, which was cheaper and more effective than its predecessor thermal cracking. Shell's lubricants were also much improved. In 1950 Shell formed a partnership with Ferrari in Formula One to help develop its lubricants – a partnership which endures to this day.

In 1953, as rationing finally ended, Shell in the UK was allowed for the first time since the war to sell petrol under its own brand name. It prompted a huge advertising campaign. It was a time when Shell used visiting artists and published its famous road guides, all of which contributed to building the Shell brand.

But the sensitivity of the oil industry to volatile political environments was demonstrated by events such as the sequestration of assets in Iran (1951-53) and in Egypt during the Suez crisis (1956-57). This "new reality" was to impinge more strongly on the Group in later decades. It led to a new emphasis on security of supply; refineries would in future be built near their markets, crude oil would be transported through a network of pipelines and in more supertankers.

In the late 1950s the Group's structure was reorganised, with new operating companies created below the two holding companies and the setting up of a Committee of Managing Directors to set direction. This structure was to survive for almost 40 years.

In tandem with this reorganisation, work began in London on a major new headquarters building for Shell Transport, Shell Centre. When it opened in 1963 it was London's tallest building. Other new Shell buildings went up around the world, in Melbourne, Toronto and Caracas.

1960s to the 1980s

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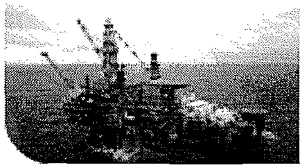

The 1960s strengthened Shell's presence in the Middle East. The Dutch Groningen gas field and North Sea gas were discovered and Shell Chemicals entered a golden period for research. The 1973 oil crisis brought cheap energy to an end and Shell adopted a policy of diversification. In 1976 Shell produced its General Business Principles.

Shell opened the 1960s by strengthening its presence in the Middle East through involvement in Oman. Ignoring early disappointments that saw its initial partners drift away, it was rewarded by discovering oil in Yibal in Oman's most prolific field. It helped bring an entirely new oil country into production. The Groningen gas field in the Netherlands was also discovered at the start of the decade, closely followed by the discovery of gas in the North Sea.

This was a golden period for research by Shell Chemicals and it employed a number of distinguished scientists including Lord Rothschild and Professor Sir John Cornforth. Among many inventions and discoveries in its laboratories were expoxy resins, insecticides including Vapona fly spray, herbicides and liquid detergents.

During the 1960s, Shell took the decision to internationalise the company. A policy of placing local people in top positions in a given country was adopted and the recruitment of Asians, Africans and South Americans was pursued, giving them as much independence as possible. This diversification of staff reflected the wider political changes of the end of Empire and its attitudes, and this far-sighted decision took Shell into the modern world.

The closure of the Suez Canal for eight years from 1967 confirmed the wisdom of the decision to invest in supertankers. The worldwide spread of its business and its operating flexibility enabled Shell to survive the disruption to supplies caused by the difficulty of transporting oil from the Middle East.

Another major development in shipping was the start of the transport of LNG by sea. The first commercial scheme by Conch International Methane, in which Shell held a 40 per cent interest, delivered LNG to the UK from Algeria for the first time in 1964. Further projects followed, in particular delivery from Brunei to Japan starting in 1972.

Although the 1960s were years of remarkable growth for the oil industry and Shell, by the end of the decade, storm clouds were gathering. In late 1969, Colonel Ghaddafi took power in Libya after a coup. Libya at that time was the source for a quarter of all the crude oil consumed in Europe but the new government cut production and increased prices. This was the breaching of the dam and every other producing nation threatened to follow suit.

The Yom Kippur of 1973 brought the crisis to a head. Within a matter of weeks, the OPEC producing countries quadrupled the price of oil from $3 per barrel to $12 per barrel and for two months imposed a supply boycott. The effects on the Western world were economically catastrophic, driving inflation to unforeseen heights and plunging trade into recession. An era of cheap energy had come to an end and oil was no longer a buyer's market.

To survive, Shell had adopted a policy of diversification – in particular into coal, nuclear power and metals. In 1970, it purchased Billiton, a metals mining company, an old-established Dutch company (later sold).

In 1973, Shell moved into nuclear energy by forming a partnership with Gulf Oil to manufacture gas-cooled reactors and their fuels. The initial cost was $200 million but Shell quickly discovered that the political problems of the oil industry were multiplied in the nuclear industry, particularly after the accident at Three Mile Island in the USA in 1979, which set the industry back by decades. The following year Shell sold its interests.

The third leg of the diversification policy was coal, but success was limited.

The 1970s were chiefly remarkable for Shell's work in developing the oil fields in the North Sea. This was the most difficult offshore work the Group had ever undertaken. Although the water is not particularly deep, the weather conditions are adverse and the instability of the sea-bed necessitated a huge investment to extract the oil. Reduced supplies from the Middle East, however, and the size of the fields in the North Sea justified the cost.

The Amoco Cadiz disaster ended the decade. This tanker ran aground the coast of France and broke up, spilling its entire crude oil cargo. Shell did not own the tanker but it did own the oil and it suffered the public backlash against oil companies as a result. The incident proved a catalyst for the industry to raise environmental standards.

In 1976, to ensure ethical businesss standards across Shell's global operations, the Group produced its Statement of General Business Principles. These, regularly updated, still govern Shell's conduct in all its countries of operation today.

The Iranian revolution in 1979 triggered the second oil price shock as the supply of oil from this critically important country dried up. The Iran-Iraq war which began later that year added to the supply problems: the price of oil doubled and carried on rising, reaching $37 a barrel. In response the Group sought cost saving, renewed its search for non-OPEC sources of oil and sought further diversification.

In production, the Group stepped up its development of subsea exploration both in the North Sea and the United States. The development of the Cognac platform was a huge technical achievement - at 1100 feet high it was a record breaking height.

The Group's early steps into renewable energy began with solar heating with the acquisition of a 50% interest in an Australian company Solarhart. It also moved into forestry, producing softwoods for paper, construction and fuel. Out of this came its interest in biomass integrated gasification, and eventually the new biofuels of which Shell is today the world's leading distributor.

1980s to the new century

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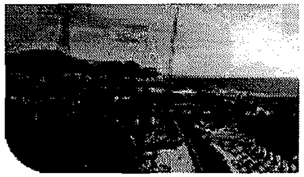
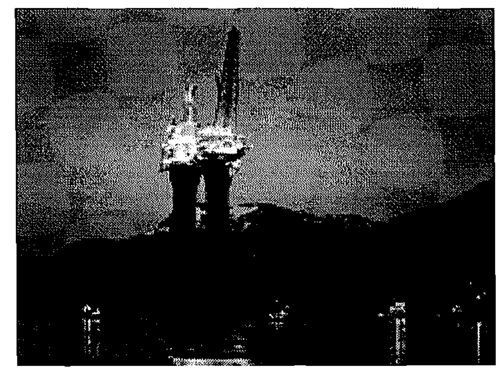


In the 1980s, Shell grew through acquisition and started some of its challenging offshore exploration projects. During the 90s Shell founded its LNG business and at the beginning of the millennium it started moving into new growth areas in the East. In 2005, Royal Dutch and Shell Transport were unified under Royal Dutch Shell plc.

In the 1980s, Shell sought to grow through acquisition. It bought out the remaining 30% shareholding in Shell Oil in 1985 to consolidate its American operations. This was a period of consolidation in the industry through mergers and acquisition activity – a necessary move as trading conditions became difficult. Shell also sold down its stockpile, anticipating to some extent the coming weakness in the oil price.

In 1986 the oil price collapsed. OPEC had lost power in the market place as other non-OPEC sources came on stream, including the North Sea output. It had initially tried to ignore price pressures through cutting production but it abandoned this strategy in late 1985 and turned on the taps. The price fell over the winter from $31 per barrel to $10.

After years of living with a high oil price, the Group had to adjust to low prices, requiring a change in the way it judged investment projects. The budget was halved within two years: the company had to work much harder to develop new projects more cheaply. Intensive research led to huge improvements in drilling techniques such as slim-hole drilling and directional drilling. The use of 3D seismic became widespread.



The 1980s saw the development of offshore exploration projects, which were in much more challenging conditions than had previously been attempted. The Troll field in Norway was one example; another was in the Gulf of Mexico where a new well was drilled at a depth of 2.3 kilometres, a new record.

In 1989, the Communist regimes of Eastern Europe collapsed, reopening these markets for Shell for the first time since the Second World War. The Group began to steadily accumulate assets; the first was a joint venture in auto retailing in Hungary, which rapidly grew to fifty outlets. But the more strategic ventures were in Russia which offered opportunities for joint production agreements as well as marketing.

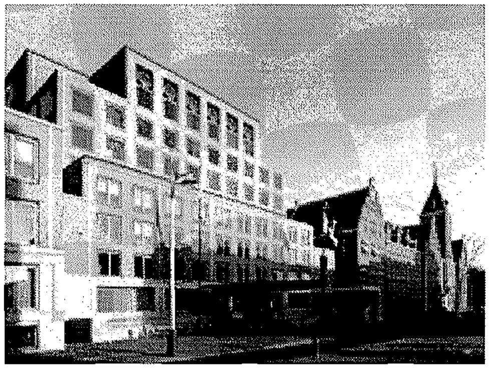
The 1990s saw the technology of biomass fuels and Gas to Liquids make giant leaps forward. The basic technology had been established for several decades but the cheap, plentiful supplies of crude oil meant there had been little interest in developing it commercially. The opening of Shell's Bintulu plant in Malaysia in 1993 was a pioneering step, a precursor to the importance Gas to Liquids was to play in the Group in the following decade.

Shell was criticised over the Brent Spar episode in 1995, which centred on its plans to dispose of the storage platform. The Group learned that public opinion had become much more sensitive to environmental issues. In the next decade, the Group worked much harder to open a dialogue with interested parties regarding its environmental impact and to develop good relations with the communities affected by its work.

Another problem to hit the Group arose from its presence in the Nigerian region of Ogoniland. The tribal minority in the Ogoni were aggrieved with the Nigerian government because they felt denied a proper share of federal revenues from the oil, and what they saw as other fundamental human rights. Their champion was the writer Ken Saro-Wiwa. The oil companies were targeted as "collaborators" with the corrupt government. Shell was accused of environmental despoliation. The story achieved international notoriety when Saro-Wiwa and eight of his colleagues were sentenced to death by hanging for their activities.

Shell has since strived to follow a policy of demonstrating its community of interests and reciprocal good feeling with both the governments and the local populaces it deals with.

The 1990s were notable for Shell for the development of the LNG gas business. Improved transportation and rising demand made this area of the Group's activities increasingly important and are expected to continue to do so in the first decades of the twenty-first century.



The turn of the century saw Shell begin to move into new growth areas of the world – notably China and Russia. It has several huge oil and gas projects in development in Russia, at Salym and Sakhalin, and it has built a massive petrochemicals plant in China to supply its rapidly-growing consumer market. Oil exploration projects have become more complex as the Group finds itself working in increasingly hostile environments. Shell's record of technological innovation is critical to its ability to partner national governments keen to exploit their natural resources.

In 2005, the Group underwent a major structural reorganisation as the near century old partnership between Royal Dutch and Shell Transport and Trading was dissolved and one company was created, Royal Dutch Shell. The headquarters of the new Group are in the Hague. As the Group approaches the first centenary of the original partnership, it looks forward with confidence to its next 100 years of operations.

The history of the Shell logo

× close

For more than 100 years the word 'Shell', our "Pecten" emblem and our distinctive red and yellow colours have identified the Shell brand and promoted our corporate reputation. These symbols have stood not only for the quality of our products and services, but also as very visible representations of our professionalism and values in all of our business activities, and to all of our stakeholders, around the world.

The word 'Shell' first appeared in 1891, as the trade mark for kerosene being shipped to the Far East by Marcus Samuel and Company. This small London business dealt originally in antiques, curios and oriental seashells. These became so popular – the Victorians used them to decorate trinket boxes in particular – that soon they formed the basis of the company's profitable import and export trade with the Far East.

The word was elevated to corporate status in 1897, when Samuel formed The "Shell" Transport and Trading Company. The first logo (1901) was a mussel shell, but by 1904 a scallop shell or 'Pecten" emblem had been introduced to give a visual manifestation to the corporate and brand name.

1900 1904 1909 1930 1948

Exploring the origins

The choice of a shell as an emblem was not surprising, as it was the company name. Also, each of Samuel's tankers carrying kerosene to the Far East had been named after a different seashell. But why specifically was the scallop or Pecten chosen as the company's symbol in 1904? It was certainly not the simplest shape to reproduce in printed form.

Both the word "Shell" and the Pecten symbol may have been suggested to Samuel and Co. by another interested party. A Mr Graham, who imported Samuel's kerosene into India and sold it as 'Graham's Oil', subscribed capital to, and became a director of, The "Shell" Transport and Trading Company.

There is some evidence that the Shell emblem was taken from his family coat of arms. The 'St James's Shell' had been adopted by the Graham family after their ancestors made the pilgrimage to Santiago de Compostella in Spain. Whatever its origins, the original design was a reasonably faithful reproduction of the Pecten or scallop shell.

When the Royal Dutch Petroleum Company and "Shell" Transport and Trading merged in 1907 it was the latter's brand name and symbol which then became the short form name ("Shell") and the visible emblem (the "Pecten") of the new Royal Dutch/Shell Group. And so it has remained ever since.

The form of the Shell emblem has changed gradually over the years in line with trends in graphic design. The current emblem was created by the great designer Raymond Loewy and introduced in 1971. Thirty years on it stands the test of time as one of the world's most recognised symbols.

Why red and yellow?

The exact origins of the Shell red and yellow are hard to define. True, Samuel and Company first shipped kerosene to the Far East in tin containers painted red. But the link, once again, could be with Spain.

In 1915, when the Shell Company of California first built service stations, they had to compete against other companies. Bright colours were the solution, but colours that would not offend the Californians. Because of the state's strong Spanish connections, the red and yellow of Spain were chosen.

As with the Pecten, the actual colours have been modified over the years, most notably in 1995 when a bright, fresh and very consumer friendly new Shell Red and Shell Yellow were introduced to launch Shell's new retail visual identity. The Shell emblem - or Pecten - remains one of the greatest brand symbols in the 21st Century.

Download The history behind the Shell emblem (PDF, size 92Kb) - opens in new window.

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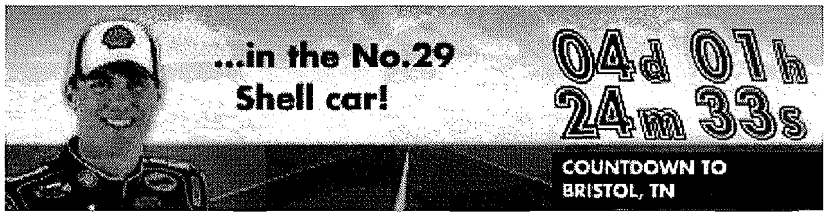

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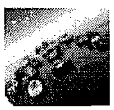

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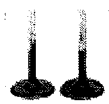

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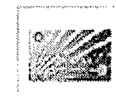

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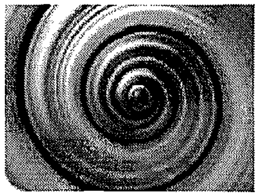

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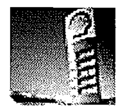

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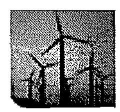

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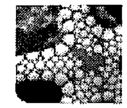

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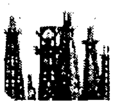
Who We Are

Here you will find information on Shell's companies and affiliates as well as achievements and milestones during its history.

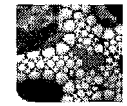
Shell Oil Company
Learn about Shell Oil Company in the United States.

The Shell Group
Read about what makes up the Shell Group.



History of Shell
Learn more about the history of Shell and its many significant achievements as told through the efforts of its people.

Shell U.S. Brochure



Download our new Shell in the U.S. brochure.

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Shell Oil Company

printable version

Shell Oil Company is an affiliate of the Shell Group, a global group of energy and petrochemical companies, employing approximately 109,000 people and operating in more than 140 countries and territories. Approximately 22,000 Shell employees are based in the U.S.

Shell Oil Company, including its consolidated companies and its share in equity companies, is one of America's leading oil and natural gas producers, natural gas marketers, gasoline marketers and petrochemical manufacturers. Shell, a leading oil and gas producer in the deepwater Gulf of Mexico, is a recognized pioneer in oil and gas exploration and production technology.

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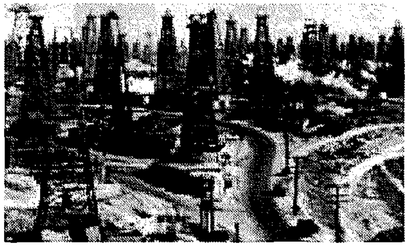
1912–1941 Early Milestones

× close



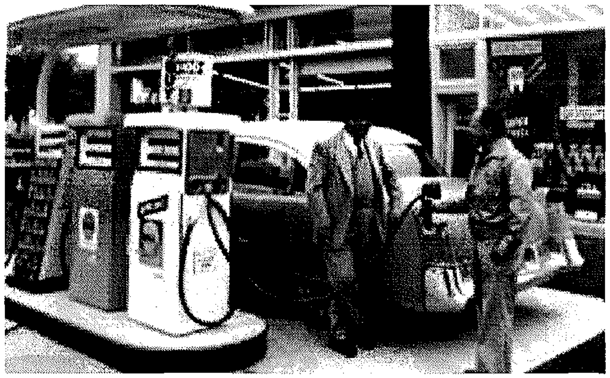
1912 - The Beginning
In 1912, the Royal Dutch/Shell Group founded the American Gasoline Company to sell gasoline along the Pacific Coast and Roxanna Petroleum to buy oil product properties in Oklahoma.
1915 – First Continuous Process Refinery
Completed in 1915, Shell's Martinez Refinery was the country's first modern, continuous-process refinery, requiring only occasional shutdowns for cleaning. For years, it served as a model for other U.S. refineries.
1921 – Signal Hill
The Signal Hill field in California was discovered by Shell in 1921. This historic strike set off an oil boom, with the good news travelling so fast the drilling crews were forced to spend much of their time herding sightseers off the derrick floor. Signal Hill became the nation's most productive field, in terms of barrels per acre.
1928 – Shell Development Company Formalised
In 1928, Shell Development Company was organized to identify chemical products that could be made from refinery byproduct gases. One year later, Shell Chemical Company was chartered to manufacture these products, which range today from industrial chemicals to polymers and catalysts to consumer products.
1931 – Synthetic Ammonia
In 1931, Shell Chemical opened its Shell Point synthetic ammonia plant near Pittsburgh, California. It was the first plant in the world to use natural gas to make ammonia. Agricultural production then depended upon plentiful and cheap synthetic ammonia to radically simplify fertilizer application.
1941 – 100-Octane Gasoline
Shell scientists invented a way to synthesize the 100-octane gasoline needed for a new generation of aviation engines. This discovery would have history-shaping implications in World War II. At the beginning of World War II, Shell manufactured 25% of the 100-octane aviation gasoline used by the military.

Shell History Home | 1912-1941 | 1942-1991 | 1992-2000

1942-1991 Discoveries and Inventions

× close

Shell Discoveries and Inventions 1942 - 1991



1943 Butadiene and Synthetic Rubber
In 1943, Shell helped launch a new synthetic rubber industry by supplying butadiene, a critical building block of synthetic rubber. The need to find a replacement for normal rubber arose during World War II when the fall of Singapore and the capture of Java by Japan deprived the U.S. of 90 percent of its rubber supply.

1946 – Discoveries in Louisiana and Texas
After World War II, the demand for oil products increased dramatically. This increased demand fueled Shell's search for new fields, and led to the discovery of oil and gas reservoirs in Louisiana and Texas. One, the Louisiana Weeks Island field, was brought into production with the deepest producing well in the world at the time.

1958 – Ranch style Service Stations
In 1958, Shell redesigned its service stations and introduced the ranch-style station. This type of station was unique in that it was the first one designed to blend in with the environment -- a concept that has been imitated for years.

1963 – Jet-powered Car
Shell products fueled and lubricated the three-wheeled, jet-powered car that set the land speed record on August 5, 1963. Driven by Craig Breedlove, a 26-year-old Californian, his "Spirit of America" achieved 407.45 miles per hour on the Salt Flats at Bonneville, Utah.

1972 – CO2 Injection
Shell pioneered testing of the CO_2 injection process, an enhanced recovery technique, by becoming the first to inject CO_2 in a West Texas oil field. This photo shows the Cortez Pipeline, a 500-mile joint-venture carbon dioxide line which transports CO_2 from the McElmo Dome Field in Colorado to West Texas and New Mexico oil fields.

1974 – Polymer Technology
In 1974, Shell Chemical became the largest manufacturer of epoxy resins, which are widely used for coatings, adhesives, and in structural materials. Recreational shoes made with Shell's KRATON® thermoplastic rubber became popular. KRATON® was also used to make toys that were safe, strong, and bounced back into shape.

1978 – Cognac
Shell brought the Cognac oil and gas field into production in 1,025 feet of water in the Gulf of Mexico. Cognac was deeper than any previous offshore discovery, and held that record for ten years. To develop this field, the company designed and built the world's tallest and heaviest drilling and production platform.

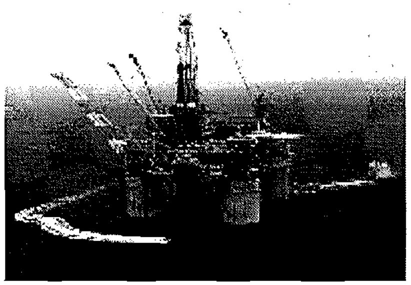
1979 – Unleaded Fuel
In 1979, Shell introduced a second grade of unleaded gasoline and upgraded its existing unleaded gasoline to the highest octane unleaded it had ever marketed. This new high octane fuel was called Super Regular Unleaded.

1983 – Seismic Vessel
Shell's leadership in seismic exploration was embodied in the 1983 launch of Shell America. This 300-foot vessel helped locate potential oil and gas reservoirs more rapidly. The ship's many features included the ability to transmit selected data by satellite to Houston for immediate processing.

1988 – Bullwinkle
In 1988, in a world record 1,350 feet of water, Shell installed the Bullwinkle platform in the Gulf of Mexico. In 1991, with the installation of permanent production facilities, Bullwinkle reached full production of 44,000 barrels of oil and 100 million cubic feet of gas per day.

1992-Present - Extending the Vision

× close



1994 – First Tension Leg Platform
Auger was the world's first tension leg platform (TLP) that had both a permanent drilling rig and full-fledged production facilities. It was installed in the Gulf of Mexico in 1994 at a then world water depth record of 2,860 feet. Auger's structure is basically a floating hull that supports a five-story deck over an area the size of two football fields.

1995 – Learning Centre Open
In 1995, the Shell Learning Center was opened. Located 40 minutes north of downtown Houston in an idyllic woodland setting, the Learning Center is designed to encourage "out-of-the-box" free thinking, and to act as a practice field for new ideas.

1996 – Mars Project
In July of 1996, the Mars platform was installed in 2940 feet of water, surpassing the previous depth record for the Gulf of Mexico established by Shell's Auger Tension Leg Platform. Mars was the largest oil and gas discovery in the Gulf of Mexico in two decades.

1996 Corterra Polymers Development
Shell Chemical was instrumental in the development of Corterra Polymers, which have extensive applications in the carpet and textile markets. Corterra Polymers combine the chemical resistance characteristics of polyester and the shape recovery properties of nylon.

1997 – Shell Houston Open Golf Tournament
In 1997, the Shell Houston Open donated a record $2.1 million to local charities, making this tournament one of the top two charity events on the PGA Tour. Since Shell assumed the sponsorship of this tournament in 1992, more than $7.2 million has been donated to area charities.

1997 – Project Gemini
In March of 1997, Shell, Texaco and Saudi Aramco announced Project Gemini, a joint venture that would combine their Eastern and Gulf Coast United States refining and marketing businesses. Upon approval by the Federal Trade Commission, this joint venture would allow the three companies to accomplish fundamental change in the way they operate their downstream businesses.

1997 – World Water Depth Record Broken
Shell broke the world's water depth record for production by almost 2,000 feet when the Mensa subsea development began flowing gas from its first well in 5,300 feet of water in the Gulf of Mexico on July 12th.

1998 – Count on Shell at the Winter Olympics
Shell was the sole petroleum products advertiser during CBS-TV's 17-day coverage of the 1998 Winter Olympic Games in Nagano, Japan. The Games also served as a launching pad for Shell's new advertising campaign, Count on Shell, which included five new television commercials and the debut of a series of information booklets starting with Driving Dangers.

Shell History Home | 1912-1941 | 1942-1991 | 1992-2000

What We Do

× close

Shell Oil Company is indeed an oil company. But we are much more; in fact, we are an affiliate of the Shell Group, a global group of energy and petrochemical companies, employing approximately 109,000 people and operating in more than 140 countries and territories. Approximately 22,000 Shell employees are based in the U.S.

In the U.S., Shell is probably best known for our bright red and yellow service stations and our ongoing success in finding and producing oil and gas on land and at sea. But do you know about Shell's wind farms in the U.S.? Do you know about Shell Trading or Shell Global Solutions? Take a few minutes to learn more about Shell in the U.S., from refineries to renewables and from retail to trading.

Shell Oil Products US

Motiva Enterprises

Shell Exploration & Production Company (SEPCo)

Shell Chemical LP and Shell Norco, Shell Chemical LP's facility in Louisiana

Shell US Gas & Power

Shell Global Solutions

Shell Renewables

Shell Lubricants

Shell Trading

Shell Hydrogen

Contact Us

Shell Headquarters Address

Royal Dutch Shell plc
Carel van Bylandtlaan 16
2596 HR DEN HAAG
Postbus 162
2501 AN DEN HAAG

Tel. 070 - 377 9111

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Egypt
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Eritrea
Estonia
Ethiopia
Fiji
Finland
France
Gabon
Gambia
Germany
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Greece
Grenada
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Guatemala
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Netherlands
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New Caledonia
New Zealand
Nicaragua
Niger
Nigeria
Niue Island
Norway
Oman
Pakistan
Panama
Serbia & Montenegro
Singapore
Slovakia
Slovenia
Solomon Islands
South Africa
Spain
Sri Lanka
St Kitts
St Lucia
St Vincent
Sudan
Surinam
Swaziland
Sweden
Switzerland
Syria
Taiwan
Thailand
Togo
Tonga
Trinidad
Tunisia
Turkey

Chile
China
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Croatia
Cuba
Czech Republic
Denmark
Djibouti
Dominican Republic
Ecuador

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Website Shell United States

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Phone +1 713 245 1500

Website www.shellchemicals.com

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Fax +1 713 241 4044

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Fax +1 281 544 3010

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Texas 77210

Phone +1 281 544 3402

Shell Western E&P Inc.

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Texas 77001-0576

Phone +1 281 544 2121

Fax +1 281 544 3010

Shell US Gas & Power

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Phone +1 866-203-9200

Website www.Shell-USGP.com

Shell Offshore Inc.

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Phone +1 281 544 2121

Fax +1 281 544 3010

Shell Deer Park Refining Company

Address	P.O. Box 100 Deer Park Texas 77536
Phone	+1 713 246 4371
Fax	+1 713 246 6462

Shell Norco Refining Company

Address	P.O. Box 10 15536 River Road Norco Louisiana 70079
Phone	+1 504 465 7810
Fax	+1 504 465 6310

Royal Lubs Co Inc

Address	P.O. Box 518 East Hanover New Jersey 07936
Phone	+1 973 887 7410
Fax	+1 973 887 8404

Royal Additives

Address P.O. Box 2463
Houston
Texas 77252

Phone +1 713 245 1500

Fax +1 713 241 0108

Shell Atlantic Services Company

Address One Shell Plaza, 910
Louisiana Room 2740
Houston
Texas 77002

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Fax +1 713 241 6418

Shell Pipeline Company LP

Address P.O. Box 2648
Houston
Texas 77252 - 2648

Phone +1 713 245 1500

Fax +1 713 241 2844

Pecten Chemicals Inc

Address P.O. Box 4407
Houston
Texas 77210

Phone +1 713 245 1500

Fax	+7 713 241 5194

Montell North America Inc

Address	P.O. Box 15439 Wilmington Delaware 19850-5439
Phone	+1 302 996 6000
Fax	+1 302 996 6051

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John Hofmeister
President, Shell Oil Company

Lynn Elsenhans
Executive Vice President, Global Manufacturing for Shell's refining business and chemicals manufacturing worldwide

Mark Hanafin
Global VP Gas and Power for Shell Trading and CEO of Shell Trading Gas and Power (including Coral Energy) in Houston

Fran Keeth
Executive Vice President Chemicals and President & CEO Shell Chemical LP

Cathy Lamboley
Senior Vice President, General Counsel and Corporate Secretary Shell Oil Company

Marvin Odum
Executive Vice President for the Americas for Shell Exploration & Production

Pervis Thomas
Managing Director and Chief Investment Officer, Shell Retirement Funds and U.S. Country Finance Functional Lead

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Shell Oil Company

1 Shell Plaza, 910 Louisana St.
Houston, TX 77002 (Map)
http://www.shellus.com

Phone: 713-241-6161
Fax: 713-241-4044

Hoover's coverage by Stuart Hampton

Overview

Shell Oil doesn't shilly-shally around, it explores for, produces, and markets oil, natural gas, and chemicals. The company's Shell Exploration & Production unit focuses its exploration on the deepwater plays in the Gulf of Mexico. Shell partners with Saudi Aramco in a US refining and marketing venture (Motiva), and owns Motiva's sister company Shell Oil Products US (formerly Equilon). Shell also produces petrochemicals (Shell Chemical) and liquefied natural gas (Shell US Gas & Power), and markets natural gas and electricity. Shell's parent, Royal Dutch Shell, is the world's #3 petroleum company (behind Exxon Mobil and BP).

Sample Overview & History

Key Numbers

Key financials for Shell Oil Company

Company Type	Subsidiary of Royal Dutch Shell
Fiscal Year-End	December

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Key People

Key people and executives for Shell Oil Company

President and Country Chair and SVP, Corporate Affairs and Human Resources	John D. Hofmeister
VP, Government Affairs	Brian P. Malnak
Director, Human Resources	Ronnie Kurtin

TIP: Use **Build Executive List** to target decision makers by industry, geography, sales, net income, and number of employees.

Top Competitors

Top competitors of Shell Oil Company

BP
Chevron
Exxon Mobil

There are 21 competitors for Shell; see more.

BBF000057

44

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BUSINESS SUMMARY

SHELL OIL COMPANY
(SUBSIDIARY OF SHELL PETROLEUM INC, HOUSTON, TX)
SHELL
SHELL DEVELOPMENT CO DIV
910 Louisiana (one Shell Plaza)
Houston, TX 77002

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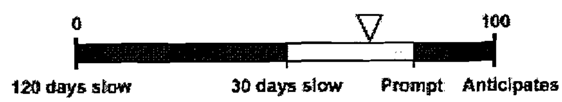
This is a **headquarters (subsidiary)** location.
Branch(es) or division(s) exist.

Mailing address:	PO Box 2463 Houston, TX 77252
Web site:	www.shellus.com
Telephone:	713 241-6161
Chief executive:	JOHN HOFMEISTER, PRES
Year started:	1912
Management control:	1922
Employs:	24,008 (1,500 here)
History:	CLEAR
SIC:	5541 4612 1311 2821 2869 2911
Line of business:	Oil & gas refining, transporting & marketing

D-U-N-S Number:	00-809-0938
D&B Rating:	--
D&B PAYDEX®:	

12-Month D&B PAYDEX: 68
When weighted by dollar amount, payments to suppliers average 17 days beyond terms.



Based on trade collected over last 12 months.

NEW! Enhanced payment trends and industry benchmarks are available on this business

SPECIAL EVENTS

01/22/2007
Typically companies prepare their fiscal financial statement within a few months of their fiscal year end close. However, for some businesses this timeframe varies considerably and their fiscal statment availability may be delayed. D&B generally begins to request an updated fiscal statement approximately 2-3 months after the fiscal

BBF000058

close.

07/05/2006
D&B has made multiple requests for an updated financial statement from this business. The business has yet to provide this information. If an updated financial statement is received, it will be promptly made available in the Finance and/or Statement Update section.

02/24/2006
OTHER SPECIAL EVENT: According to published reports on September 26, 2005, Shell announced the re-opening of its downtown New Orleans offices.

SUMMARY ANALYSIS

D&B Rating:--

The blank rating symbol should not be interpreted as indicating that credit should be denied. It simply means that the information available to D&B does not permit us to classify the company within our rating key and that further enquiry should be made before reaching a decision. Some reasons for using a "-" symbol include: deficit net worth, bankruptcy proceedings, insufficient payment information, or incomplete history information. For more information, see the D&B Rating Key.

Below is an overview of the company's rating history since 01/01/91:

D&B Rating	Date Applied
--	01/01/91

The Summary Analysis section reflects information in D&B's file as of March 19, 2007.

NEW! **Have SHELL OIL COMPANY's payment habits changed over time?**
A Payment Trends Profile will show you - View Now

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HISTORY

The following information was reported **11/08/2006**:

Officer(s): JOHN HOFMEISTER, PRES
LYNN ELSENHANS, SR V PRES GLOBAL MANUFACTURING
CATHY LAMBOLEY, SR V PRES-GEN COUNSEL-SEC

DIRECTOR(S): The officers identified by (+)

Charter amended Sep 22 1949 changing name from Shell Union Oil Corporation.

Business started 1912. Present control succeeded 1922.

BACKGROUND/OWNERSHIP:
Business started 1912 by two predecessor companies, but has been a direct or indirect subsidiary of the Royal Dutch/Shell Group since 1922.

Shell Petroleum N.V. had owned approximately 69% of the company's common stock with the balance held by the general public. In Apr 1984, however, Shell Petroleum N.V., through its newly formed subsidiary, SPNV Holdings Inc (SPNV), commenced a tender offer for all of the publicly held shares of subject it did not already own.

On Jun 7 1985, SPNV completed the acquisition of subject from its public shareholders at a total cost of some $5.5 billion. Previously Shell Petroleum N.V. had contributed its common stock ownership in subject to SPNV. On Dec 31 1987 SPNV changed its corporate name by charter amendment to Shell Petroleum Inc. Shell Petroleum Inc is now 60% owned by Royal Dutch Petroleum Co, The Hague, The Netherlands, and 40% owned by The "Shell" Transport and Trading Company, plc, London, England.

RECENT EVENTS:

On August 14, 2003, an inside source, stated that Shell Oil Company, Houston, TX completed the previously announced sale of its 50-percent interest in the Excel Paralubes venture to a subsidiary of Flint Hills Resources, LLC, a Wichita, Kansas-based refining and chemical company. The Federal Trade Commission approved the sale, the terms of which were not released. ConocoPhillips hold the other 50-percent interest in Excel Paralubes. It is located adjacent to the ConocoPhillips refinery near Lake Charles, LA. Further details are unavailable at this time.

On April 2, 2003, Max R Rudminat, secretary-treasurer-CFO for Warren Oil Company Inc, Dunn, NC stated that the company has acquired two blending packaging plants from Shell Oil Company, Houston, TX. The plants are located in Marion, IL and Johnstown, PA. Both plants were formerly part of the Penzoil-Quaker State Company. Further details are unavailable at this time.

On February 13 2002 Shell Oil Company, Houston, TX, acquired the remaining 44% interest of Equilon Enterprises LLC, Houston, TX that it didn't already own from Texaco Inc, White plains, NY. In a related transaction, Shell Oil Company and Saudi Refining Inc, Houston, TX purchased Texaco Inc's interest in Motiva Enterprises LLC, Houston, TX. Each now has a 50% interest.

OFFICERS BACKGROUND:

JOHN HOFMEISTER. Appointed president on March 1 2005. Mr. Hofmeister joined Shell as Director of Human Resources, based in The Hague, The Netherlands, and London, UK, in 1997. Prior to joining Shell he served as Vice President, International Human Resources, for AlliedSignal Inc, based in Hong Kong. He joined AlliedSignal in 1992. Mr. Hofmeister holds bachelors and masters degrees in political Science from Kansas State University.

LYNN ELSENHANS. Ms. Elsenhans graduated from Rice University with a BA in Mathematical Science in 1978 and received an MBA from Harvard in 1980 before joining Shell Oil Company. She was named to president and CEO of Shell Oil Products U.S., and president Shell Oil Company and Country Chair for Shell U.S. in June of 2003. She was named to her current position, Executive Vice President of Global Manufacturing, with responsibility for Shell's refining business and chemicals manufacturing worldwide, with effect from January 1, 2005.

CATHY LAMBOLEY. Active with Shell for 25 years. She has had various assignments in the Legal organization and also was vice president of Commercial Marketing & Services for the Oil Products business. She was named Senior Vice President, General Counsel & Corporate Secretary in June 2000 Graduated with a B.S. degree in Secondary Education from the University of Wisconsin in 1972 and a J.D. degree from the University of Texas in 1979.

RELATED CONCERNS:

Altura Energy, Ltd was formed and began operations in Mar 1997 by combining the company's exploration and producing operations located in the Permian Basin of West Texas/Southwest New Mexico with those of Amoco Corporation. Altura is owned approximately 36% by the company and 64% by Amoco.

Aera Energy LLC, DUNS#090755471, was formed and began operations in Jul 1997 by combining the California exploration and production operations of CalResources, a subsidiary, with the California exploration and production operations of Mobil Corporation. The company owns 58.6% of Aera but does not exercise control and therefore accounts for its investment using the equity method of accounting.

In Jan 1998, the company and Texaco Inc reached agreement on the formation and operational start up of Equilon Enterprises LLC. Equilon is a joint venture, which combines major elements of both company's western and midwestern United States refining and marketing businesses and both company's nationwide trading, transportation and lubricants businesses. The company owns 56 percent in Equilon using the equity method of accounting.

On Jun 22 1998 the company, Texaco and Saudi Arabian Oil Company reached agreement on the formation and operational start up effective Jul 1 1998, of Motiva Enterprises LLC, a joint venture combining major elements of the three companies' eastern and Gulf Coast United States refining and marketing businesses, including assets previously held by Star Enterprise, a partnership of corporate affiliates of Texaco and Saudi Aramco. The company has a 35 percent ownership of Motiva, and Texaco and Saudi Refining each have 32.5 percent ownership of Motiva.

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Buy Selected Report(s)

Global Ultimate:

Royal Dutch Shell Plc	London, England	DUNS # 42-379-2808

Parent:

Shell Petroleum Inc.	Houston, TX	DUNS # 13-148-9817

Subsidiaries (US):

Coral Energy Holding, L P	Houston, TX	DUNS # 83-756-5548
Enventure Global Technology LLC	Houston, TX	DUNS # 07-457-5767
Equilon Enterprises L. L. C.	Houston, TX	DUNS # 00-429-4737
Houston Fuel Oil Terminal Inc	Houston, TX	DUNS # 62-663-2343
Nickerson American Plant Breeders Inc	Houston, TX	DUNS # 80-170-7845
Pecten Arabian Co	Houston, TX	DUNS # 19-513-1578
Pecten Chemicals Inc	Houston, TX	DUNS # 02-734-2260
Pecten Trading Company	Houston, TX	DUNS # 08-150-4219
Pennzoil-Quaker State Company	Houston, TX	DUNS # 16-180-9744
Shell Catalyst Ventures, Inc	Houston, TX	DUNS # 16-167-7778
Shell Chemical LP	Houston, TX	DUNS # 01-777-4071
Shell Chemical Risk Management Company Inc	Houston, TX	DUNS # 17-670-5267
Shell Communications Inc	Houston, TX	DUNS # 80-192-9456
Shell Energy Resources Inc	Wilmington, DE	DUNS # 06-538-1345
Shell Exploration & Production Inc	Coden, AL	DUNS # 79-091-6381
Shell Frontier Oil & Gas Inc	Houston, TX	DUNS # 13-657-0939
Shell Gas Lpg Bulk LLC	Fremont, MI	DUNS # 04-755-5347
Shell Global Solutions (us) Inc	Houston, TX	DUNS # 60-321-4508
Shell Information Technology International Inc	Houston, TX	DUNS # 15-992-9249
Shell International Exploration and Production Inc.	Houston, TX	DUNS # 60-162-8071
Shell Martinez Refinery	Martinez, CA	DUNS # 96-357-3175
Shell Motorist Club Inc	Houston, TX	DUNS # 09-483-0437
Shell Pipeline Company L P	Houston, TX	DUNS # 00-793-2593
Shell Polymers Ventures, Inc	Houston, TX	DUNS # 62-114-6794
Shell Wind Energy Inc	Houston, TX	DUNS # 12-946-8067

Subsidiaries (International):

Shell Company (W.I.) Ltd	PORT-AU-PRINCE, HAITI	DUNS # 87-203-0796

Branches (US):

Shell Oil Company	Alabaster, AL	DUNS # 93-335-4078
Shell Oil Company	Birmingham, AL	DUNS # 15-583-7974
Shell Oil Company	Birmingham, AL	DUNS # 09-838-4766
Shell Oil Company	Collinsville, AL	DUNS # 04-729-6020
Shell Oil Company	Mobile, AL	DUNS # 15-561-6295

Shell Oil Company	Saraland, AL	DUNS # 02-085-2422
Shell Oil Company	Anchorage, AK	DUNS # 62-512-3091
Shell Oil Company	Kenai, AK	DUNS # 12-023-2111
Shell Oil Company	Fayetteville, AR	DUNS # 04-693-7772
Shell Oil Company	Anaheim, CA	DUNS # 09-470-5324
Shell Oil Company	Anaheim, CA	DUNS # 62-535-2380
Shell Oil Company	Antioch, CA	DUNS # 36-232-2307
Shell Oil Company	Bell, CA	DUNS # 16-516-0425
Shell Oil Company	Castaic, CA	DUNS # 60-274-5523
Shell Oil Company	Chula Vista, CA	DUNS # 93-058-8223
Shell Oil Company	Fallbrook, CA	DUNS # 16-867-3911
Shell Oil Company	Long Beach, CA	DUNS # 00-754-2884
Shell Oil Company	Long Beach, CA	DUNS # 02-843-0999
Shell Oil Company	Long Beach, CA	DUNS # 16-520-6483
Shell Oil Company	Los Angeles, CA	DUNS # 96-626-5696
Shell Oil Company	Los Angeles, CA	DUNS # 16-515-7801
Shell Oil Company	Los Angeles, CA	DUNS # 00-469-2583
Shell Oil Company	Los Angeles, CA	DUNS # 93-007-5718
Shell Oil Company	Los Angeles, CA	DUNS # 93-358-7446
Shell Oil Company	Mojave, CA	DUNS # 78-191-8768

This list is limited to the first 25 branches.
For the complete list, use D&B's Global Family Linkage product.

Affiliates (US):*(Affiliated companies share the same parent company as this business.)*

Shell Consolidated Refining Company	Houston, TX	DUNS # 09-239-2443
Shell Deepwater Development Holdings, Inc	Houston, TX	DUNS # 09-239-4795
Shell Deepwater Development Inc.	Houston, TX	DUNS # 09-239-4910
Shell Gulf of Mexico Inc	Houston, TX	DUNS # 14-454-0528
Shell Marine Products (u.s.) Company	Houston, TX	DUNS # 11-140-3213
Shell Oil & Gas Investment Limited Partnership	Houston, TX	DUNS # 09-239-5206
Shell Trading North America Company	Houston, TX	DUNS # 12-271-2792

Affiliates (International):*(Affiliated companies share the same parent company as this business.)*

AUSTRALIAN LNG SHIP OPERATING CO. PTY. LTD.	PERTH, AUSTRALIA	DUNS # 75-238-9726
BP + SHELL MARKETING SERVICES (PTE) LIMITED	HARARE, ZIMBABWE	DUNS # 56-551-0435
CPC SHELL LUBRICANTS COMPANY LTD.	Kaohsiung City, TAIWAN	DUNS # 65-600-2813
PENNZOIL PRODUCT INTERNATIONAL COMPANY	PORT LOUIS, MAURITIUS	DUNS # 36-471-1791
Shell Autoserv México, S.A. de C.V.	CIUDAD DE MEXICO, MEXICO	DUNS # 58-815-1121
SHELL AZS	St.Petersburg, RUSSIA	DUNS # 56-551-4577
SHELL BUSINESS DEVELOPMENT CENTRAL ASIA B.V.	BAKU, AZERBAIJAN	DUNS # 56-554-1554
SHELL BUSINESS DEVELOPMENT CENTRAL ASIA B.V.	Almaty, KAZAKHSTAN	DUNS # 56-552-1213
Shell Caribbean & Central America Ltd.	SANTO DOMINGO, DOMINICAN	DUNS # 87-146-7957

	REPUBLIC	
SHELL CENTRAL EUROPE SERVICES COMPANY LIMITED	KIEV, UKRAINE	DUNS # 56-551-8607
Shell Colombia, S.A.	BOGOTA, COLOMBIA	DUNS # 88-004-9259
Shell Company (W.I.) Ltd. (Jamaica)	JAMAICA	DUNS # 87-327-0065
Shell Company WI Ltd.	SANTO DOMINGO, DOMINICAN REPUBLIC	DUNS # 87-144-4154
Shell Costa Rica, S.A.	SAN JOSE, COSTA RICA	DUNS # 88-016-4934
SHELL DEVELOPMENTS ZIMBABWE (PTE) LIMITED	HARARE, ZIMBABWE	DUNS # 56-551-0427
SHELL EAST EUROPE COMPANY LIMITED	KIEV, UKRAINE	DUNS # 36-475-1672
SHELL EXPLORATION & PRODUCTION SERVICES (RF) BV	MOSCOW, RUSSIA	DUNS # 56-545-3201
SHELL EXPLORATION AND PRODUCTION ANGOLA B V	LUANDA, ANGOLA	DUNS # 64-513-9148
SHELL GAS ROMANIA S.A.	BUCHAREST, ROMANIA	DUNS # 55-256-9881
SHELL LIETUVA UAB	VILNIUS, LITHUANIA	DUNS # 64-739-2526
Shell México, S.A. de C.V.	CIUDAD DE MEXICO, MEXICO	DUNS # 81-101-2772
SHELL ROMANIA SRL	BUCHAREST, ROMANIA	DUNS # 56-553-4646
SHELL SOUTH AFRICA MARKETING (PTY) LTD	Cape Town, SOUTH AFRICA	DUNS # 53-848-2795
SHELL TAIWAN LIMITED	Taipei City, TAIWAN	DUNS # 65-623-2535
SHELL ZIMBABWE (PTE) LIMITED	HARARE, ZIMBABWE	DUNS # 56-551-0422

This list is limited to the first 25 affiliates.
For the complete list, use D&B's Global Family Linkage product.

Buy Selected Report(s)

BUSINESS REGISTRATION

CORPORATE AND BUSINESS REGISTRATIONS PROVIDED BY MANAGEMENT OR OTHER SOURCE

The Corporate Details provided below may have been submitted by the management of the subject business and may not have been verified with the government agency which records such data.

Registered Name: SHELL OIL COMPANY (INC)

Business type: CORPORATION
Corporation type: PROFIT
Date incorporated: FEB 08 1922
State of incorporation: DELAWARE
Filing date: FEB 08 1922

Common stock
Authorized shares: 1,000
Par value: $10.0000

Where filed: SECRETARY OF STATE/CORPORATIONS DIVISION, DOVER, DE

OPERATIONS

11/08/2006

Description: Subsidiary of SHELL PETROLEUM INC, HOUSTON, TX started 1984 which operates as an oil and gas company primarily through subject. Parent company owns 100% of capital stock. Intercompany relations: Consist of occasional loans and advances and service transactions.

As noted, this company is a subsidiary of Shell Petroleum Inc, DUNS #13-148-9817, and reference is made to that report for background information on the parent company and its management. Financial statements on Shell Petroleum Inc have been declined by management.

Shell Petroleum Inc is in turn 60% owned by Royal Dutch Petroleum Company (Inc), The Hague, The Netherlands, started 1890, and operates with interests in oil and gas operations worldwide and 40% owned by The "Shell" Transport and Trading Company, plc, London, England. Intercompany relations: Exchange of merchandise on market terms.

The company, including its equity companies, is engaged, principally in the United States, in the exploration for, and development, production, purchase, transportation and marketing of, crude oil and natural gas, and the purchase, manufacture, transportation and marketing of oil and chemical products. In addition, the company is engaged in the exploration for, and production of, crude oil and natural gas outside the United States.

The company manages its business activities through four major operating segments: oil and gas exploration and production, downstream gas, oil products and chemical products. Downstream gas was established as a new operating segment effective Jan 1 1998. The oil products segment consists predominantly of the company's investment in companies which are engaged in the refining, transportation and marketing of oil products; the company accounts for its investment in these companies using the equity method of accounting.

Terms: Vary, but generally net 30 days. Has 20,000 accounts excluding credit cards. Sells to wide range of industry, government, wholesalers, retailers, and individuals. Territory : Worldwide. Marketing through pipelines, bulk stations, terminals and retail service stations.

Nonseasonal.

Employees: 24,008 which includes officer(s). 1,500 employed here.

Facilities: Rents premises in a 50 story office building. Rents most floors of 50 story building.

Location: Central business section on main street.

Branches: The company has numerous branches nationwide including refineries, chemical plants, service stations and coal mines.

Subsidiaries: This business has multiple subsidiary, detailed subsidiary information is available in Dun & Bradstreets linkage or family tree products.

SIC & NAICS

SIC:

Based on information in our file, D&B has assigned this company an extended 8-digit SIC. D&B's use of 8-digit SICs enables us to be more specific to a company's operations than if we use the standard 4-digit code.

The 4-digit SIC numbers link to the description on the Occupational Safety & Health Administration (OSHA) Web site. Links open in a new browser window.

55419901	Filling stations, gasoline
46120000	Crude petroleum pipelines
13110101	Crude petroleum production
13110102	Natural gas production
28210101	Epoxy resins
28210210	Polypropylene resins
28690200	Olefins
28690100	Alcohols, non beverage
29110000	Petroleum refining
29110101	Gas, refinery
29110101	Gas, refinery
29110203	Jet fuels

NAICS:

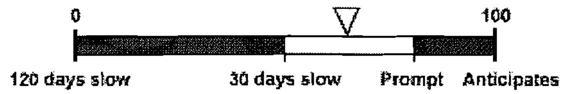
447190	Other Gasoline Stations
486110	Pipeline Transportation of Crude Oil
211111	Crude Petroleum and Natural Gas Extraction
211111	Crude Petroleum and Natural Gas Extraction
325211	Plastics Material and Resin Manufacturing
325211	Plastics Material and Resin Manufacturing
325110	Petrochemical Manufacturing
325199	All Other Basic Organic Chemical Manufacturing
324110	Petroleum Refineries
324110	Petroleum Refineries
324110	Petroleum Refineries
324110	Petroleum Refineries

D&B PAYDEX

NEW! Enhanced payment trends and industry benchmarks are available on this business

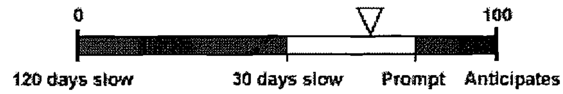
The D&B PAYDEX is a unique, dollar weighted indicator of payment performance based on up to 717 payment experiences as reported to D&B by trade references.

3-Month D&B PAYDEX: 67
When weighted by dollar amount, payments to suppliers average 18 days beyond terms.



Based on trade collected over last 3 months.

12-Month D&B PAYDEX: 68
When weighted by dollar amount, payments to suppliers average 17 days beyond terms.



Based on trade collected over last 12 months.

When dollar amounts are not considered, then approximately 67% of the company's payments are within terms.

PAYMENT SUMMARY

The Payment Summary section reflects payment information in D&B's file as of the date of this report.

Below is an overview of the company's dollar-weighted payments, segmented by its suppliers' primary industries:

	Total Rcv'd (#)	Total Dollar Amts ($)	Largest High Credit ($)	Within Terms (%)	Days Slow (%) <31	31-60	61-90	90>
Top industries:								
Nonclassified	41	4,291,800	2,000,000	40	7	-	-	53
Whol electrical equip	14	1,208,750	400,000	46	31	6	-	17
Mfg computers	6	1,461,000	1,000,000	49	1	48	2	-
Computer maintenance	5	1,555,000	750,000	77	23	-	-	-
Petroleum refining	3	14,100,000	8,000,000	99	1	-	-	-
Mfg plastics/resins	3	4,201,000	4,000,000	-	48	52	-	-
Mfg truck/bus bodies	3	1,025,000	1,000,000	50	-	1	-	49
Mfg pesticides	2	5,600,000	5,000,000	89	-	11	-	-
Oil/gas exploration	2	1,085,000	1,000,000	46	8	46	-	-
Scheduled air trans	1	1,000,000	1,000,000	100	-	-	-	-
OTHER INDUSTRIES	588	9,514,800	600,000	57	26	11	2	4
Other payment categories:								
Cash experiences	18	4,450	2,500					
Payment record unknown	23	1,323,250	1,000,000					
Unfavorable comments	5	900	500					
Placed for collections:								
With D&B	2	200						
Other	1	N/A						
Total in D&B's file	717	46,371,150	8,000,000					

The highest **Now Owes** on file is $8,000,000

The highest **Past Due** on file is $800,000

Dun & Bradstreet has 717 payment experiences in its file for this company. For your convenience, we have displayed 80 representative experiences in the PAYMENTS section.

NEW! **How does SHELL OIL COMPANY's payment record compare to its industry?**
A Payment Trends Profile will show you - View Now

PAYMENT DETAILS

Detailed Payment History

Date Reported (mm/yy)	Paying Record	High Credit ($)	Now Owes ($)	Past Due ($)	Selling Terms	Last Sale Within (months)
03/07	Ppt	50,000	30,000	0		1 mo
	Ppt	5,000	5,000	0		1 mo
	Ppt	2,500	0	0		2-3 mos
	Ppt	2,500	0	0	N30	6-12 mos
	Ppt	1,000	1,000	0		1 mo
	Ppt	1,000	1,000	0		1 mo
	Ppt	1,000	0	0		6-12 mos
	Ppt	500	0	0		4-5 mos
	Ppt	250	0	0	N30	6-12 mos
	Ppt	50	0	0		4-5 mos
	Ppt-Slow 30	40,000	25,000	0		1 mo
	Ppt-Slow 60	60,000	15,000	0		1 mo
	Slow 30	50	50	50		6-12 mos
	Slow 15-60	50	0	0		1 mo
02/07	Ppt	1,000,000	0	0	N30	6-12 mos
	Ppt	250,000	250,000	10,000		1 mo
	Ppt	45,000	0	0		6-12 mos
	Ppt	20,000	20,000	500		1 mo
	Ppt	10,000	0	0		2-3 mos
	Ppt	10,000	10,000	0		1 mo
	Ppt	10,000	0	0		6-12 mos
	Ppt	5,000	0	0	N30	6-12 mos
	Ppt	2,500	0	0	N30	6-12 mos
	Ppt	2,500	0	0	N30	6-12 mos
	Ppt	2,500	0	0	N30	6-12 mos
	Ppt	2,500	1,000	0		1 mo
	Ppt	2,500	2,500	2,500		1 mo
	Ppt	2,500	0	0		6-12 mos
	Ppt	2,500	50	0		1 mo
	Ppt	1,000	0	0		1 mo
	Ppt	1,000	0	0	N30	6-12 mos
	Ppt	1,000	1,000	0	N30	1 mo
	Ppt	1,000	0	0		6-12 mos
	Ppt	750	0	0	N30	6-12 mos
	Ppt	750	250	0		1 mo
	Ppt	500	500	0		1 mo
	Ppt	500	0	0		1 mo
	Ppt	250	250	0		1 mo
	Ppt	100	100	0		1 mo
	Ppt	100	50	0		1 mo
	Ppt	100	0	0	N30	6-12 mos
	Ppt	100	100	0		1 mo
	Ppt	50	0	0		6-12 mos
	Ppt	0	0	0		1 mo
	Ppt	0	0	0	N30	1 mo
	Ppt	0	0	0		1 mo
	Ppt	0	0	0	N15	1 mo

Ppt	0	0	0		1 mo
Ppt-Slow 30	200,000	0	0		1 mo
Ppt-Slow 30	5,000	2,500	1,000	N30	1 mo
Ppt-Slow 30	2,500	0	0		1 mo
Ppt-Slow 30	2,500	0	0	N30	4-5 mos
Ppt-Slow 30	1,000	1,000	1,000		1 mo
Ppt-Slow 30	250	50	0		1 mo
Ppt-Slow 30	100	50	0		1 mo
Ppt-Slow 30	50	0	0		6-12 mos
Ppt-Slow 60	20,000	7,500	5,000		1 mo
Ppt-Slow 60	15,000	5,000	0		1 mo
Ppt-Slow 60	2,500	2,500	500		1 mo
Ppt-Slow 90	15,000	10,000	10,000		1 mo
Ppt-Slow 120	40,000	40,000	10,000		1 mo
Ppt-Slow 120	500	100	100		6-12 mos
Ppt-Slow 120	250	250	100		1 mo
Slow 5	200,000	100,000	30,000	N30	1 mo
Slow 5	55,000	55,000	0	N30	1 mo
Slow 30	250	0	0	N30	4-5 mos
Slow 30	100	0	0		1 mo
Slow 30	50	0	0	N30	6-12 mos
Slow 60	45,000	1,000	0		1 mo
Slow 30-60	10,000	750	750		6-12 mos
Slow 60	2,500	0	0		6-12 mos
Slow 90	500	250	250		1 mo
Slow 30-90+	30,000	5,000	2,500		1 mo
Slow 15-110	1,000	500	500		4-5 mos
Slow 30-120	15,000	15,000	15,000		1 mo
Slow 30-120	2,500	750	750		1 mo
Slow 120	500	0	0		2-3 mos
Slow 120	100	0	0		6-12 mos
Slow 180	5,000	5,000	5,000		
(080)	0	0	0	Cash account	4-5 mos

Payment experiences reflect how bills are met in relation to the terms granted. In some instances payment beyond terms can be the result of disputes over merchandise, skipped invoices etc.

Each experience shown is from a separate supplier. Updated trade experiences replace those previously reported.

NEW! **Have SHELL OIL COMPANY's payment habits changed over time?**

A Payment Trends Profile will show you - View Now

FINANCE

02/24/2006

Two-year statement comparative:

	Fiscal Consolidated Dec 31 2002 (000s omitted)	Fiscal Consolidated Dec 31 2003 (000s omitted)
Current Assets	11,456,000	14,906,000
Current Liabs	10,609,000	13,489,000
Current Ratio	1.08	1.11

Working Capital	847,000	1,417,000
Other Assets	30,301,000	33,027,000
Net Worth	11,146,000	11,553,000
Sales	60,052,000	41,468,000
Long Term Liab	20,002,000	22,891,000
Net Profit (Loss)	1,844,000	3,421,000

Accountant: PricewaterhouseCoopers LLP, Houston, Texas.

Shell Oil Company operates as a wholly owned subsidiary of Shell Petroleum Inc. The ultimate parent is Royal Dutch Shell plc, The Hague, Netherlands. Financial information is prepared on a consolidated basis and is available through the ultimate parent's business information report.

KEY BUSINESS RATIOS

Statement date: DEC 31 2003
Based on this number of establishments: 98

Firm		**Industry Median**	
Return of Sales:	UN	Return of Sales:	0.6
Current Ratio:	UN	Current Ratio:	1.3
Assets / Sales:	UN	Assets / Sales:	17.5
Total Liability / Net Worth:	UN	Total Liability / Net Worth:	122.4

UN = Unavailable
D&B has been unable to obtain sufficient financial information from this company to calculate business ratios. Our check of additional outside sources also found no information available on its financial performance.
To help you in this instance, ratios for other firms in the same industry are provided below to support your analysis of this business.

BANKING

(Mar 1999) According to the company's Dec 31 1998 Form 10K, the company had $1,259 million of unused revolving credit agreements in place as of Dec 31 1998, which were available for general corporate purposes, including support of commercial notes. None of the agreements require compensating balances. Under the agreements, interest will be based on rates in effect at the time of borrowing.

PUBLIC FILINGS

The following Public Filing data is for information purposes only and is not the official record. Certified copies can only be obtained from the official source.

JUDGMENTS

Judgment award:	**$250**
Status:	**Unsatisfied**
CASE NO.:	1064152
Judgment type:	Judgment
Against:	BROADWAY SHELL, SANTA MARIA, CA
In favor of:	GAYNELL DELANEY
Where filed:	SANTA BARBARA COUNTY SMALL CLAIMS COURT/SANTA MARIA, SANTA MARIA, CA
Date status attained:	11/19/2001
Date entered:	11/19/2001
Latest Info Collected:	03/29/2002

Judgment award: **$409**

Status:	**Unsatisfied**
DOCKET NO.:	49K060102SC01819
Judgment type:	Judgment
Against:	VILLAGE PARK SHELL, CARMEL, IN
In favor of:	COCA-COLA BOTTLING COMPANY OF INDIANAPOL
Where filed:	MARION COUNTY SMALL CLAIMS/WARREN TOWNSHIP DIVISION, INDIANAPOLIS, IN
Date status attained:	03/20/2001
Date entered:	03/20/2001
Latest Info Received:	04/18/2001

Judgment award:	**$425**
Status:	**Unsatisfied**
DOCKET NO.:	49K060011SC09369
Judgment type:	Judgment
Against:	SHELL SERVICE STATION, INDIANAPOLIS, IN
In favor of:	COCA-COLA BOTTLING CO OF INDIANAPOLIS IN
Where filed:	MARION COUNTY SMALL CLAIMS/WARREN TOWNSHIP DIVISION, INDIANAPOLIS, IN
Date status attained:	12/12/2000
Date entered:	12/12/2000
Latest Info Received:	01/26/2001

Judgment award:	**$364**
Status:	**Unsatisfied**
CASE NO.:	99M15846
Judgment type:	Judgment
Against:	JIN'S HOLLYWOOD SHELL, LOS ANGELES, CA and OTHERS
In favor of:	CAROL MCNALLY MAYHEW
Where filed:	LOS ANGELES COUNTY SMALL CLAIMS COURT/LOS ANGELES, LOS ANGELES, CA
Date status attained:	08/27/1999
Date entered:	08/27/1999
Latest Info Received:	10/19/2004

Judgment award:	**$245**
Status:	**Unsatisfied**
DOCKET NO.:	97-SC-0618
Judgment type:	Judgment
Against:	SHELL OIL COMPANY (INC)
In favor of:	HALM'S MOTOR SER INC, PERU, IL
Where filed:	LA SALLE COUNTY CIRCUIT COURT, OTTAWA, IL
Date status attained:	04/22/1997
Date entered:	04/22/1997
Latest Info Collected:	05/21/1997

SUITS

Status:	**Dismissed**
DOCKET NO.:	A0507877
Plaintiff:	BARBARA HAUNERT
Defendant:	SHELL OIL COMPANY
Where filed:	HAMILTON COUNTY COMMON PLEAS COURT, CINCINNATI, OH
Date status attained:	12/29/2006
Date filed:	09/22/2005
Latest Info Received:	02/27/2007

Suit amount:	**$2,020**
Status:	**Dismissed**
CASE NO.:	05A02170
Plaintiff:	ROSA BERMEO DBA FERGUSON COMPANY
Defendant:	SHELL, LOS ANGELES, CA AND OTHERS
Where filed:	LOS ANGELES COUNTY SMALL CLAIMS COURT/SANTA MONICA, SANTA MONICA, CA

Date status attained:	10/24/2005
Date filed:	09/20/2005
Latest Info Received:	11/28/2005

Status:	**Pending**
CASE NO.:	596890
Plaintiff:	JULIE ANN VOGEL
Defendant:	SHELL OIL CO, KENNER, LA AND OTHERS
Where filed:	JEFFERSON PARISH 24TH JUDICIAL COURT, GRETNA, LA
Date status attained:	07/24/2003
Date filed:	07/24/2003
Latest Info Received:	08/15/2003

Suit amount:	**$150**
Status:	**Judgment entered**
DOCKET NO.:	001342902
Plaintiff:	JAMES R GEBBIA
Defendant:	SHELL OIL COMPANY
Cause:	TORT
Where filed:	ANNE ARUNDEL COUNTY DISTRICT COURT, GLEN BURNIE, MD
Date status attained:	05/06/2003
Date filed:	11/14/2002
Latest Info Received:	08/11/2003

Status:	**Pending**
CASE NO.:	86176
Plaintiff:	PROFESSIONAL PATIOS AND SCREENS
Defendant:	SHELL OIL, GRETNA, LA
Where filed:	JEFFERSON 2ND PARISH COURT-GRETNA, GRETNA, LA
Date status attained:	07/23/2002
Date filed:	07/23/2002
Latest Info Received:	03/22/2004

Status:	**Pending**
CASE NO.:	580715
Plaintiff:	CHRISTINE GAJE
Defendant:	SHELL OIL COMPANY, GRETNA, LA
Where filed:	JEFFERSON PARISH 24TH JUDICIAL COURT, GRETNA, LA
Date status attained:	05/10/2002
Date filed:	05/10/2002
Latest Info Received:	05/31/2002

Status:	**Dismissed**
DOCKET NO.:	02CVE016503
Plaintiff:	STATE FARM FIRE & CASUALTY COMPANY
Defendant:	SHELL OIL COMPANY, COLUMBUS, OH
Where filed:	FRANKLIN COUNTY MUNICIPAL COURT, COLUMBUS, OH
Date status attained:	08/21/2002
Date filed:	05/08/2002
Latest Info Received:	09/16/2003

Status:	**Dismissed**
DOCKET NO.:	CV02010295
Plaintiff:	MARLIN SHTEIWI ET AL
Defendant:	SHELL OIL COMPANY, FAIRFIELD, OH AND OTHERS
Where filed:	BUTLER COUNTY COMMON PLEAS COURT, HAMILTON, OH
Date status attained:	03/10/2003
Date filed:	01/31/2002
Latest Info Received:	07/29/2003

Suit amount:	**$1,040**
Status:	**Dismissed**
DOCKET NO.:	02CV00703
Plaintiff:	STATE FARM MUTUAL AUTO INSURANCE COMPANY

Defendant:	SHELL OIL COMPANY, FAIRFIELD, OH AND OTHERS
Where filed:	HAMILTON COUNTY MUNICIPAL COURT, CINCINNATI, OH
Date status attained:	03/14/2002
Date filed:	01/10/2002
Latest Info Received:	11/25/2002

Suit amount:	**$5,000**
Status:	**Judgment for defendant**
CASE NO.:	1065150
Plaintiff:	GAYNELL DELANEY
Defendant:	BROADWAY SHELL, SANTA MARIA, CA
Where filed:	SANTA BARBARA COUNTY SMALL CLAIMS COURT/SANTA MARIA, SANTA MARIA, CA
Date status attained:	01/18/2002
Date filed:	11/27/2001
Latest Info Collected:	03/29/2002

If it is indicated that there are defendants other than the report subject, the lawsuit may be an action to clear title to property and does not necessarily imply a claim for money against the subject.

LIENS

A lienholder can file the same lien in more than one filing location. The appearance of multiple liens filed by the same lienholder against a debtor may be indicative of such an occurrence.

Amount:	**$2,470**
Status:	**Open**
FILING NO.:	2007 003018
Type:	State Tax
Filed by:	STATE OF SOUTH CAROLINA
Against:	SHELL OIL COMPANY INC
Where filed:	GREENVILLE COUNTY REGISTER OF DEEDS, GREENVILLE, SC
Date status attained:	01/09/2007
Date filed:	01/09/2007
Latest Info Received:	03/02/2007

Amount:	**$46,879**
Status:	**Open**
CASE NO.:	473117544W
Type:	State Tax
Filed by:	STATE OF MISSISSIPPI
Against:	SHELL OIL CO
Where filed:	HINDS COUNTY CIRCUIT COURT, JACKSON, MS
Date status attained:	07/19/2005
Date filed:	07/19/2005
Latest Info Received:	08/09/2005

Amount:	**$569**
Status:	**Open**
DOCKET NO.:	04959691
Type:	State Tax
Filed by:	STATE OF INDIANA
Against:	SHELL OIL COMPANY
Where filed:	ST JOSEPH COUNTY CIRCUIT COURT, SOUTH BEND, IN
Date status attained:	01/26/2005
Date filed:	01/26/2005
Latest Info Received:	06/30/2005

Amount:	**$569**
Status:	**Released**
DOCKET NO.:	04950989
Type:	State Tax
Filed by:	STATE OF INDIANA
Against:	SHELL OIL COMPANY
Where filed:	ST JOSEPH COUNTY CIRCUIT COURT, SOUTH BEND, IN

Date status attained:	03/07/2005
Date filed:	01/11/2005
Latest Info Received:	10/11/2005

Amount:	**$569**
Status:	**Open**
DOCKET NO.:	04950620
Type:	State Tax
Filed by:	STATE OF INDIANA
Against:	SHELL OIL COMPANY
Where filed:	ST JOSEPH COUNTY CIRCUIT COURT, SOUTH BEND, IN
Date status attained:	01/10/2005
Date filed:	01/10/2005
Latest Info Received:	06/15/2005

Amount:	**$2,161**
Status:	**Released**
DOCKET NO.:	03007742738
Type:	State Tax
Filed by:	STATE OF INDIANA
Against:	SHELL OIL CO
Where filed:	ST JOSEPH COUNTY CIRCUIT COURT, SOUTH BEND, IN
Date status attained:	05/24/2004
Date filed:	12/29/2003
Latest Info Received:	01/16/2006

Amount:	**$2,337**
Status:	**Released**
DOCKET NO.:	03007678921
Type:	State Tax
Filed by:	STATE OF INDIANA
Against:	SHELL OIL COMPANY
Where filed:	ST JOSEPH COUNTY CIRCUIT COURT, SOUTH BEND, IN
Date status attained:	05/24/2004
Date filed:	12/01/2003
Latest Info Received:	01/16/2006

Amount:	**$778 Unemployment contribution**
Status:	**Open**
DOCKET/WARRANT:	6171979-00
Type:	State Tax
Filed by:	DWD
Against:	SHELL OIL COMPANY
Where filed:	BROWN COUNTY CIRCUIT COURT, GREEN BAY, WI
Date status attained:	07/09/2003
Date filed:	07/09/2003
Latest Info Collected:	07/25/2003

Amount:	**$53,895**
Status:	**Open**
DOCKET/WARRANT:	022217262
Type:	State Tax
Filed by:	STATE OF WASHINGTON
Against:	SHELL OIL CO AND OTHERS
Where filed:	THURSTON COUNTY SUPERIOR COURT, OLYMPIA, WA
Date status attained:	11/15/2002
Date filed:	11/15/2002
Latest Info Received:	12/19/2003

Amount:	**$2,449**
Status:	**Void**
CASE NO.:	0205300065
Type:	Judgment lien
Filed by:	COUNTY OF SACRAMENTO

Against:	SHELL OIL COMPANY (A CORPORATION)
Where filed:	SACRAMENTO COUNTY RECORDERS OFFICE, SACRAMENTO, CA
Date status attained:	07/19/2002
Date filed:	05/30/2002
Latest Info Received:	08/22/2002

UCC FILINGS

Collateral:	All Negotiable instruments including proceeds and products - All Accounts receivable including proceeds and products - All Inventory including proceeds and products - All General intangibles(s) including proceeds and products - and OTHERS
Type:	Original
Sec. party:	DEARBORN WHOLESALE GROCERS L.P., CHICAGO, IL
Debtor:	NISHEL OIL CORPORATION, HOOPESTON, IL and OTHERS
Filing number:	010214459
Filed with:	SECRETARY OF STATE/UCC DIVISION, SPRINGFIELD, IL
Date filed:	09/26/2005
Latest Info Received:	10/11/2005

Collateral:	All Negotiable instruments including proceeds and products - All Accounts receivable including proceeds and products - All Inventory including proceeds and products - All General intangibles(s) including proceeds and products - and OTHERS
Type:	Original
Sec. party:	DEARBORN WHOLESALE GROCERS LTD PARTNERSHIP, CHICAGO, IL
Debtor:	SHELL FOOD MART INC, CHICAGO RIDGE, IL and OTHERS
Filing number:	004163836
Filed with:	SECRETARY OF STATE/UCC DIVISION, SPRINGFIELD, IL
Date filed:	02/08/2000
Latest Info Received:	04/03/2000

Collateral:	Negotiable instruments including proceeds and products - Accounts receivable including proceeds and products - Inventory including proceeds and products - General intangibles(s) including proceeds and products - and OTHERS
Type:	Original
Sec. party:	DEARBORN WHOLESALE GROCERS L.P., CHICAGO, IL
Debtor:	MAIN & GENEVA SHELL, WHEATON, IL WESTCHESTER SHELL, WESTCHESTER, IL WHEATON SHELL, WHEATON, IL and OTHERS
Filing number:	010632285
Filed with:	SECRETARY OF STATE/UCC DIVISION, SPRINGFIELD, IL
Date filed:	02/06/2006
Latest Info Received:	02/20/2006

Collateral:	Negotiable instruments including proceeds and products - Inventory including proceeds and products - Account(s) including proceeds and products - Timber including proceeds and products - and OTHERS
Type:	Original
Sec. party:	SAEHAN BANK, LOS ANGELES, CA
Debtor:	SHELL, LOS ANGELES, CA and OTHERS
Filing number:	0203160750
Filed with:	SECRETARY OF STATE/UCC DIVISION, SACRAMENTO, CA
Date filed:	01/31/2002
Latest Info Received:	02/14/2002

Collateral:	Negotiable instruments including proceeds and products - Accounts receivable including proceeds and products - Inventory including proceeds and products - Account(s) including proceeds and products - and OTHERS
Type:	Original
Sec. party:	NATIONSBANK, N.A., AS COLLATERAL AGENT, CHARLOTTE, NC
Debtor:	N.S.A. ENTERPRISES, INC., A TEXAS CORPORATION, TOMBALL, TX and OTHERS
Filing number:	97242108
Filed with:	SECRETARY OF STATE/UCC DIVISION, AUSTIN, TX

Date filed: 11/26/1997
Latest Info Received: 12/16/1997

Collateral: Negotiable instruments and proceeds - Inventory and proceeds - Account(s) and proceeds - Chattel paper and proceeds - Contract rights and proceeds
Type: Original
Sec. party: MAJOR VIDEO CONCEPTS, INC., INDIANAPOLIS, IN
Assignee: MAJOR VIDEO CONCEPTS INC, ST. PAUL, MN
Debtor: HUNTSMAN SHELL, AIKEN, SC and OTHERS
Filing number: 980803-142154A
Filed with: SECRETARY OF STATE/UCC DIVISION, COLUMBIA, SC

Date filed: 08/03/1998
Latest Info Received: 08/14/1998

Collateral: All Accounts receivable including proceeds and products - All Inventory including proceeds and products - All Equipment including proceeds and products - All Fixtures including proceeds and products - All Chattel paper including proceeds and products
Type: Original
Sec. party: EBY BROWN COMPANY LLC, MONTGOMERY, IL
Debtor: SHELL MART, CRYSTAL LAKE, IL and OTHERS
Filing number: 004566467
Filed with: SECRETARY OF STATE/UCC DIVISION, SPRINGFIELD, IL

Date filed: 01/09/2002
Latest Info Received: 01/30/2002

Collateral: All Inventory and proceeds - All Account(s) and proceeds - All General intangibles (s) and proceeds - All Equipment and proceeds - All Chattel paper and proceeds
Type: Original
Sec. party: WILSHIRE STATE BANK, LOS ANGELES, CA
Debtor: PHILIPS SHELL SERVICE, VAN NUYS, CA and OTHERS
Filing number: 0103160121
Filed with: SECRETARY OF STATE/UCC DIVISION, SACRAMENTO, CA

Date filed: 01/29/2001
Latest Info Received: 02/12/2001

Collateral: Inventory including proceeds and products - Account(s) including proceeds and products - Contract rights including proceeds and products - General intangibles (s) including proceeds and products - and OTHERS
Type: Original
Sec. party: THE CHASE MANHATTAN BANK, N.A., AS ADMINISTRATIVE AGENT, NEW YORK, NY
Debtor: SHELL OIL COMPANY
Filing number: 00645480
Filed with: SECRETARY OF STATE/UCC DIVISION, AUSTIN, TX

Date filed: 12/20/2000
Latest Info Received: 01/31/2001

Collateral: Accounts receivable including proceeds and products - Inventory including proceeds and products - Equipment including proceeds and products - Machinery including proceeds and products - and OTHERS
Type: Original
Sec. party: FOSTER BANK, CHICAGO, IL
Debtor: SHELL GAS STATION, PALATINE, IL and OTHERS
Filing number: 004113003
Filed with: SECRETARY OF STATE/UCC DIVISION, SPRINGFIELD, IL

Date filed: 10/25/1999
Latest Info Received: 12/13/1999

Type: Termination
Sec. party: FOSTER BANK, CHICAGO, IL
Debtor: SHELL GAS STATION, PALATINE, IL and OTHERS
Filing number: 000495658
Filed with: SECRETARY OF STATE/UCC DIVISION, SPRINGFIELD, IL

Date filed:	08/16/2000
Latest Info Received:	09/07/2000
Original UCC filed date:	10/25/1999
Original filing no.:	004113003

There are additional UCC's in D&B's file on this company available by contacting 1-800-234-3867.

There are additional suits, liens, or judgments in D&B's file on this company available by contacting 1-800-234-3867.

The public record items contained in this report may have been paid, terminated, vacated or released prior to the date this report was printed.

GOVERNMENT ACTIVITY

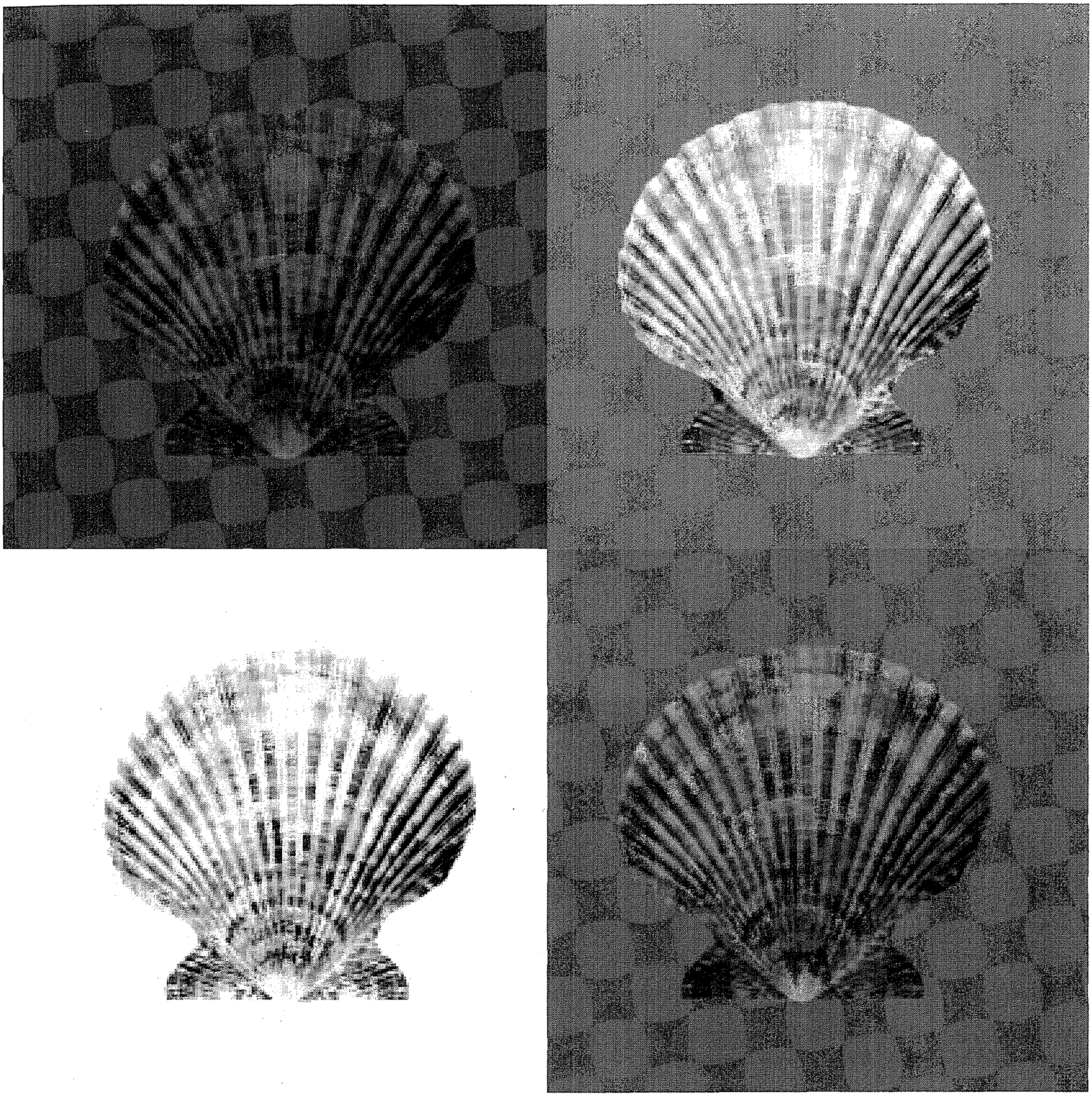
Activity summary

Borrower (Dir/Guar):	NO
Administrative debt:	NO
Contractor:	NO
Grantee:	NO
Party excluded from federal program(s):	NO

Possible candidate for socio-economic program consideration

Labor surplus area:	YES (2007)
Small Business:	N/A
8(A) firm:	N/A

The details provided in the Government Activity section are as reported to Dun & Bradstreet by the federal government and other sources.



Delivery and growth

Royal Dutch Shell plc

Annual Review and Summary Financial Statements 2006

BBF000059

ABOUT THIS REVIEW In this Review "Group" is defined as Royal Dutch Shell together with all of its consolidated subsidiaries. The expressions "Shell", "Group", "Shell Group" and "Royal Dutch Shell" are sometimes used for convenience where references are made to the Group or Group companies in general. Likewise, the words "we", "us" and "our" are also used to refer to Group companies in general or to those who work for them. These expressions are also used where no useful purpose is served by identifying the particular company or companies. The expression "Group companies" as used in this Review refers to companies in which Royal Dutch Shell either directly or indirectly has control, by having either a majority of the voting rights or the right to exercise a controlling influence. The companies in which the Group has significant influence but not control are referred to as "associated companies" or "associates" and companies in which the Group has joint control are referred to as "jointly controlled entities". In this Review, associates and jointly controlled entities are also referred to as "equity accounted investments".

The expression "operating companies" as used in this Review refers to those Group and equity accounted investments that are engaged in the exploration for and extraction of oil and natural gas and delivery of these hydrocarbons to market, the marketing and trading of natural gas and electricity, the conversion of natural gas to liquids and the refining of crude oil into products including fuels, lubricants, petrochemicals and other industry segments such as Hydrogen and Renewables. The term "Group interest" is used for convenience to indicate the direct and/or indirect equity interest held by the Group in a venture, partnership or company (i.e., after exclusion of all third-party interests).

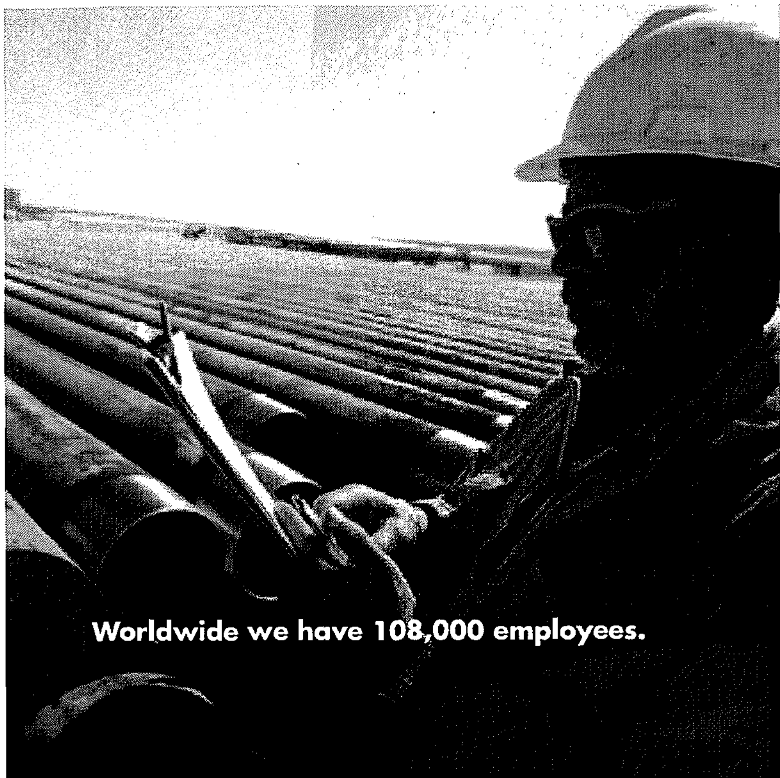
Except as otherwise specified, the figures shown in the tables in this Review represent those in respect of Group companies only, without deduction of minority interests. However, where figures are given specifically for oil production (net of royalties in kind), natural gas production available for sale, and both the refinery processing intake and total oil product sales volumes, the term "Group share" is used for convenience to indicate not only the volumes to which Group companies are entitled (without deduction in respect of minority interests) but also the portion of the volumes of equity accounted investments to which Group companies are entitled or which is proportionate to the Group interest in those companies.

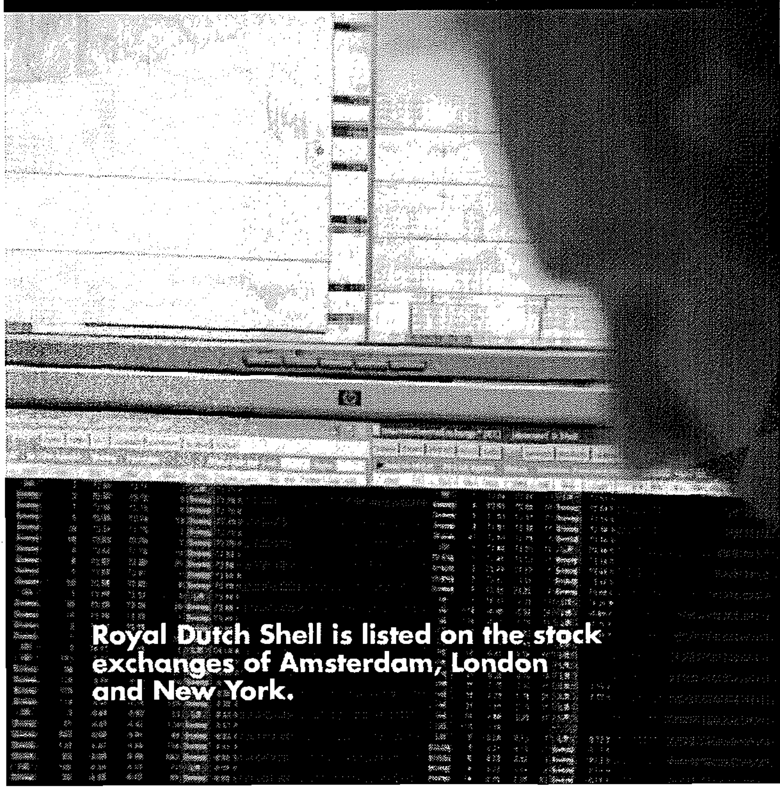
Except as otherwise stated, the Financial Statements contained in this Review have been prepared in accordance with the provisions of the Companies Act 1985, Article 4 of the International Accounting Standards (IAS) Regulation and with International Financial Reporting Standards ("IFRS") as adopted by the European Union. As applied to Royal Dutch Shell, there are no material differences with IFRS as issued by the International Accounting Standards Board.

The Consolidated Financial Statements of Royal Dutch Shell and its subsidiaries have been prepared using the carryover basis to account for the Unification and on the basis that the resulting structure was in place throughout the periods presented.

Except as otherwise noted, the figures shown in this Review are stated in US dollars. As used herein, all references to "dollars" or "$" are to the US currency.

The Summary Operating and Financial Review, an extract of the "full OFR", and other sections of this Review contain forward-looking statements concerning the financial condition, results of operations and businesses of Royal Dutch Shell. All statements other than statements of historical fact are, or may be deemed to be, forward-looking statements. Forward-looking statements are statements of future expectations that are based on management's current expectations and assumptions and involve known and unknown risks and uncertainties that could cause actual results, performance or events to differ materially from those expressed or implied in these statements. Forward-looking statements include, among other things, statements concerning the potential exposure of Royal





Delivery and growth are the basis for our success. We deliver projects, top-quality operational performance and competitive returns while investing in new developments to secure the growth of our business. Delivery is doing what we say. Growth is our future.

Dutch Shell to market risks and statements expressing management's expectations, beliefs, estimates, forecasts, projections and assumptions. These forward-looking statements are identified by their use of terms and phrases such as "anticipate", "believe", "could", "estimate", "expect", "intend", "may", "plan", "objectives", "outlook", "probably", "project", "will", "seek", "target", "risks", "goals", "should" and similar terms and phrases. There are a number of factors that could affect the future operations of Royal Dutch Shell and could cause those results to differ materially from those expressed in the forward-looking statements included in this Review, including (without limitation): (a) price fluctuations in crude oil and natural gas; (b) changes in demand for the Group's products; (c) currency fluctuations; (d) drilling and production results; (e) reserve estimates; (f) loss of market and industry competition; (g) environmental and physical risks; (h) risks associated with the identification of suitable potential acquisition properties and targets and successful negotiation and completion of such transactions; (i) the risk of doing business in developing countries and countries subject to international sanctions; (j) legislative, fiscal and regulatory developments including potential litigation and regulatory effects arising from recategorisation of reserves; (k) economic and financial market conditions in various countries and regions; (l) political risks, project delay or advancement, approvals and cost estimates; and (m) changes in trading conditions. All forward-looking statements contained in this Review are expressly qualified in their entirety by the cautionary statements contained or referred to in this section. Readers should not place undue reliance on forward-looking statements. Each forward-looking statement speaks only as of the date of this Review. Neither Royal Dutch Shell nor any of its subsidiaries undertake any obligation to publicly update or revise any forward-looking statement as a result of new information, future events or other information. In light of these risks, results could differ materially from those stated, implied or inferred from the forward-looking statements contained in this Review.

This Review contains references to Shell's website. These references are for the readers' convenience only. Shell is not incorporating by reference any information posted on www.shell.com.

Documents on display Documents concerning Royal Dutch Shell, or its predecessors for reporting purposes, which are referred to in this Review, bave been filed with the SEC and may be examined or copied at the public reference facility maintained by the SEC at 100 F Street, N.E., Room 1580. Washington D.C. 20549, USA. All the SEC filings made electronically by the Group are available to the public at the SEC website www.sec.gov (commission file number 1-32575). This Review, a Dutch language versioo of it, and the Annual Report and Form 20-F are available, free of charge, at www.shell.com/aonualreport or at the offices of Royal Dutch Shell in The Hague, the Netherlands and London, UK.

The Annual Review and Summary Financial Statements is an abridged version of the Annual Report and Form 20-F. For further information consult the full unabridged document at www.shell.com/annualreport or request a free copy from the address on the back cover.

The United States Securities and Exchange Commission (SEC) permits oil and gas companies, in their filings with the SEC, to disclose only proved reserves that a company has demonstrated by actual production or conclusive formation tests to be economically and legally producible under existing economic and operating conditions. We use certain terms in this Review, such as "resources", that the SEC's guidelines strictly prohibit us from including in filings with the SEC. US Investors are urged to read and consider closely the disclosure in our Form 20-F, File No 1-32575, available on the SEC website www.sec.gov. You can also obtain these forms from the SEC by calling 1-800-SEC-0330.

Selected financial data

The selected financial data set out below is derived from the Consolidated Financial Statements. The selected data should be read in conjunction with the Summary Consolidated Financial Statements and related Notes, as well as the Summary Operating and Financial Review in this Review.

CONSOLIDATED STATEMENT OF INCOME DATA			$ million
	2006	2005	2004
Revenue	318,845	306,731	266,386
Income from continuing operations	26,311	26,568	19,491
Income/(loss) from discontinued operations	–	(307)	(234)
Income for the period	26,311	26,261	19,257
Income attributable to minority interests	869	950	717
Income attributable to shareholders	25,442	25,311	18,540

EARNINGS PER SHARE			$
Basic earnings per €0.07 share	3.97	3.79	2.74
Diluted earnings per €0.07 share	3.95	3.78	2.74

CONSOLIDATED BALANCE SHEET DATA			$ million
	2006	2005	2004
Total assets	235,276	219,516	187,446
Share capital	545	571	604
Equity attributable to shareholders	105,726	90,924	86,070
Minority interests	9,219	7,000	5,313

OTHER CONSOLIDATED DATA			$ million
	2006	2005	2004
Cash flow provided by operating activities	31,696	30,113	26,537
Capital expenditure	22,922	15,904	13,566
Cash flow used in investing activities	20,861	8,761	5,964
Dividends paid	8,431	10,849	7,655
Cash flow used in financing activities	13,741	18,573	13,592
Increase/(decrease) in cash and cash equivalents	(2,728)	2,529	7,094
Gearing ratio [A]	14.8%	13.6%	17.5%
Dividends declared – €/share	1.00	0.92 [B]	0.86 [C]
Dividends – equivalent $/share	1.27	1.13 [B]	1.07 [C]

[A] The gearing ratio is a measure of the Group's financial leverage reflecting the degree to which the operations of the Group are financed by shareholder funds or by debt from third parties.

[B] Includes a first interim dividend of €0.23 ($0.2975) made payable to shareholders of Royal Dutch Petroleum Company in June 2005 and a first interim dividend of 15.84 pence ($0.3014) made payable to shareholders of The "Shell" Transport and Trading Company, p.l.c. in June 2005; a second interim dividend of €0.23 ($0.2771) made payable to shareholders of Royal Dutch Shell plc in September 2005; a third interim dividend of €0.23 ($0.2767) made payable to shareholders of Royal Dutch Shell plc in December 2005 and a fourth interim dividend of €0.23 ($0.2771) made payable to shareholders of Royal Dutch Shell plc in March 2006. Together they constituted the total dividend for 2005.

[C] Comprises Royal Dutch interim dividend of €0.75 made payable in September 2004 and a second interim dividend of €1.04 made payable in March 2005 as well as a Shell Transport interim dividend of 6.25 pence and a second interim dividend of 10.7 pence that are used to calculate the equivalent dividend on a Royal Dutch Shell basis.

Delivering growth

Shell is active in oil, gas, petrochemicals, coal technologies and alternative energies, including biofuels, wind, solar and hydrogen.

In 2006 we made good progress in bringing new production on stream and in developing major projects that will supply oil and gas in the future.

We also further expanded our position in unconventional oil and gas, which we see as increasing from today's production level.

We have maintained our leading position in oil products and continued to reshape our portfolio.

We made continued improvements in the operational performance of our refineries and petrochemicals plants.

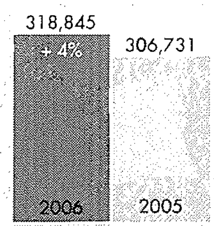
In 2007 we will build on our strengths to secure growth.
These strengths include:

Our position at the forefront of technology and innovation in the energy industry.

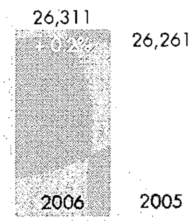
Our commitment to long-term partnerships.

Our diverse and inclusive transnational organisation.

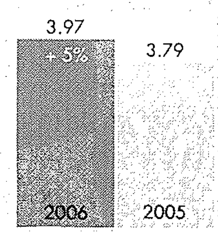
Our commitment to our business principles and sustainable development.



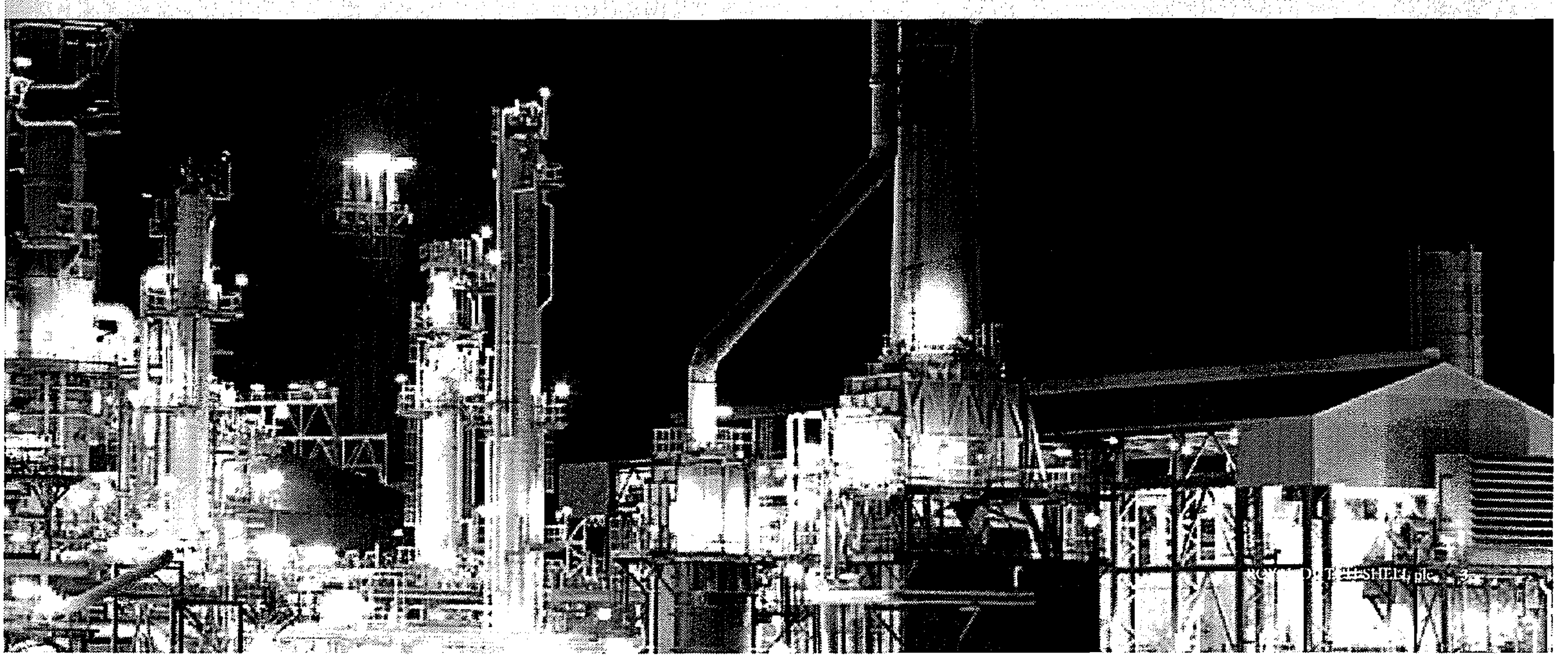
Revenue ($ million)



Income for the period ($ million)



Basic earnings per share ($)



Chairman's message

In this, my first message to shareholders, I would like to share with you some of the impressions I have gained since I became Chairman of Royal Dutch Shell plc in 2006.

The energy business, as I am seeing first-hand, is at the heart of some of the most important economic, environmental and social issues facing the world. Reliable and affordable supplies of energy are essential for economic growth and for raising living standards amongst the world's poorest people. Equally, as the growing concern over climate change shows, providing those energy supplies in a way that minimises the impact on the environment is one of the greatest challenges we all face.

Shell is playing its part in addressing those challenges. Our business strategy is focused on finding and producing the resources to help meet the world's growing demand for energy, and doing so in a responsible way. This includes researching and developing projects to reduce carbon dioxide emissions and ensuring that the operations at individual Shell facilities meet the highest environmental standards. The Board's Social Responsibility Committee has a very direct role in overseeing the company's approach to these issues and makes regular visits to Shell locations to see how environmental and social challenges are being met.

I see the Board's role as providing both support and challenge to the Chief Executive and his team in their work; and ensuring that Shell continues to provide shareholders with the returns they expect. I believe that the structures put in place since our 2005 unification provide an effective framework for the Board to fulfil that role. I would like to pay a particular tribute to my predecessor as Chairman, Aad Jacobs, for his role in seeing the company through a challenging period.

Across Shell I have met dedicated and committed people working in a productive corporate culture with very strong values. I have been particularly impressed with the way they are responding to the pace of change in the energy industry; how they are delivering strong results; and how they are putting in place plans to secure the future growth of Shell's business.

As Shell marks its centenary year, I hope shareholders share my excitement at being part of a business that is successfully playing its part in meeting the world's energy needs.

"As Shell marks its centenary year, I hope shareholders share my excitement at being part of a business that is successfully playing its part in meeting the world's energy needs."

Jorma Ollila
CHAIRMAN

Chief Executive's review

Shell performed well in 2006. Our financial position is strong and we posted record income of $26.3 billion, returning $16.3 billion to shareholders. We built on our achievements of 2005 by focusing on delivery and growth, laying solid foundations for our future.

Our strategy of more upstream, profitable downstream is on track. We made good progress in rejuvenating our diverse portfolio. Our upstream exploration efforts are paying off. We invested large stakes in major integrated long-life projects that will generate cash for decades to come. Downstream, we added to our growth portfolio, especially in China.

The security situation in Nigeria – which has shut in significant production in the Delta region – remains a serious concern and we do not know when production will resume. Our deep water projects in Nigeria really delivered in 2006, partially offsetting lost production onshore. In Sakhalin, we cleared the way forward by agreeing to partner with Gazprom on what is the world's largest integrated oil and gas project under construction.

Our Exploration & Production business performed well. Earnings were up 7% from 2005 at $15.2 billion. We added approximately 2 billion barrels of oil equivalent to our proved oil and gas reserves and proven mining reserves. The bid for the minority shares in Shell Canada and expansion of the Athabasca Oil Sands Project reaffirm our commitment to maintaining a leading position in unconventional oil.

Our Gas & Power division delivered particularly strong earnings growth of 68% at $2.7 billion. We are proceeding with construction of the Pearl Gas to Liquids (GTL) plant in Qatar, the largest such plant in the world. Sales of liquefied natural gas (LNG) grew 14%, strengthening our leading position in the LNG markets of North America, Asia Pacific and Europe.

Downstream we are investing in major manufacturing projects, particularly in Asia. The expansion of our petrochemicals complex in Singapore and a successful start-up of the Nanhai complex in China strengthen our position in Asia's dynamic markets. We acquired a 75% interest in China's leading lubricants manufacturer and marketer, making Shell the leading international lubricants company in China. Plans to expand our Port Arthur facilities would create the largest refinery in the USA.

As we operate in ever more demanding environments, safety becomes a bigger challenge. We continue to place great emphasis on training to support safety's role as a key component of operational excellence. Our safety performance in 2006 was mixed, however, with an increase in fatalities. We have responded by reinforcing our safety focus through a dedicated global safety function that will improve compliance with standards and procedures worldwide.

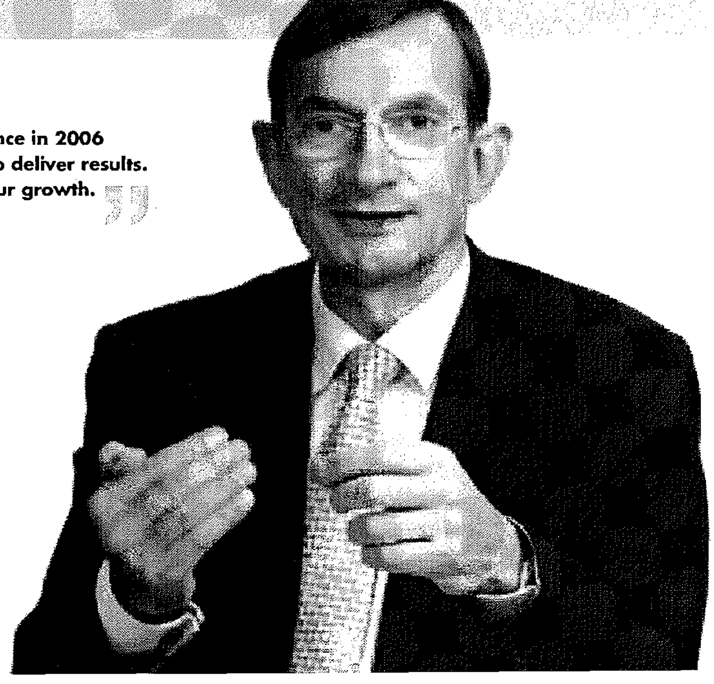
We remain committed to developing one substantial business in alternative energy. We launched our first offshore wind farm in the North Sea off the Netherlands. We continue to make progress on projects in hydrogen, advanced solar technology and second-generation biofuels.

I am convinced that technology is key to delivering our business strategy and the complex projects of the future. In 2006 we appointed a Chief Technology Officer to head our technology drive with seven Chief Scientists and thousands of technical staff at our worldwide technology centres, including our new one in Bangalore, India. We also published Shell's first Technology Report.

Technology is central to managing carbon dioxide (CO_2) emissions. Within Shell we are pursuing a range of activities to address the challenge of CO_2, including improving efficiency, reducing flaring and exploring opportunities for CO_2 capture and storage.

None of this would be possible without the efforts of our people, who I would like to thank. Our strong performance in 2006 prepares us well for the increasingly fierce competition in the energy industry and confirms our ability to deliver results to both shareholders and our partners. In 2007 we will strive to maintain our momentum by continuing to focus on delivery and growth.

"Our strong performance in 2006 confirms our ability to deliver results. This is the basis for our growth."



Jeroen van der Veer
CHIEF EXECUTIVE

What we do

Upstream

Shell's upstream businesses explore for and extract oil and natural gas, and build and operate the infrastructure necessary to deliver these hydrocarbons to market. In most countries we operate with joint venture partners.

EXPLORATION & PRODUCTION
Our Exploration & Production business searches for and recovers oil and natural gas around the world and is active in 39 countries. The majority of these activities are carried out as joint venture partnerships.

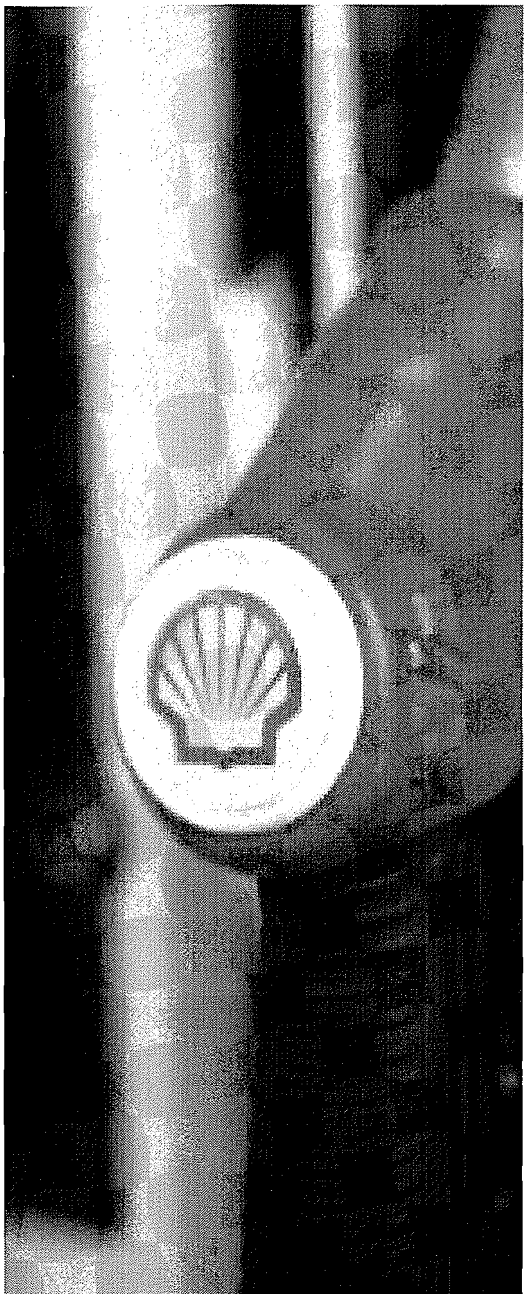
GAS & POWER
Our Gas & Power business liquefies and transports natural gas and develops natural gas markets and related infrastructure. It also markets and trades natural gas and electricity, and converts natural gas to liquids to provide clean fuels. A number of new opportunities are also emerging to apply our proprietary coal gasification process.

Downstream

Shell's downstream businesses refine crude oil into a range of products including fuels, lubricants and petrochemicals. The Group's retail network of more than 45,000 service stations is the world's largest.

OIL PRODUCTS
The Oil Products organisation comprises a number of different downstream businesses, which include Manufacturing, Supply and Distribution, Retail, Business to Business and Lubricants. Collectively these businesses refine, supply, trade and ship crude oil products around the world and market fuels and lubricants for domestic, industrial and transportation use.

CHEMICALS
Our chemicals companies produce and sell petrochemicals to industrial customers globally. The products are widely used in plastics, coatings and detergents, which in turn are used in products such as fibres and textiles, thermal and electrical insulation, medical equipment and sterile supplies, computers, lighter, more efficient vehicles and paints.



Other industry segments and Corporate

Other industry segments include our Renewables and Hydrogen businesses and CO_2 co-ordination activities.

RENEWABLES, HYDROGEN AND CO_2

Renewables develops businesses based on renewable sources of energy, including wind and solar power. Hydrogen develops business opportunities in hydrogen and fuel cell technology. Shell aims to develop at least one alternative energy source into a substantial business. Our CO_2 group co-ordinates research into carbon dioxide capture and storage.

CORPORATE

Corporate is a non-operating segment consisting primarily of interest expense on debt, and certain other non-allocated costs.

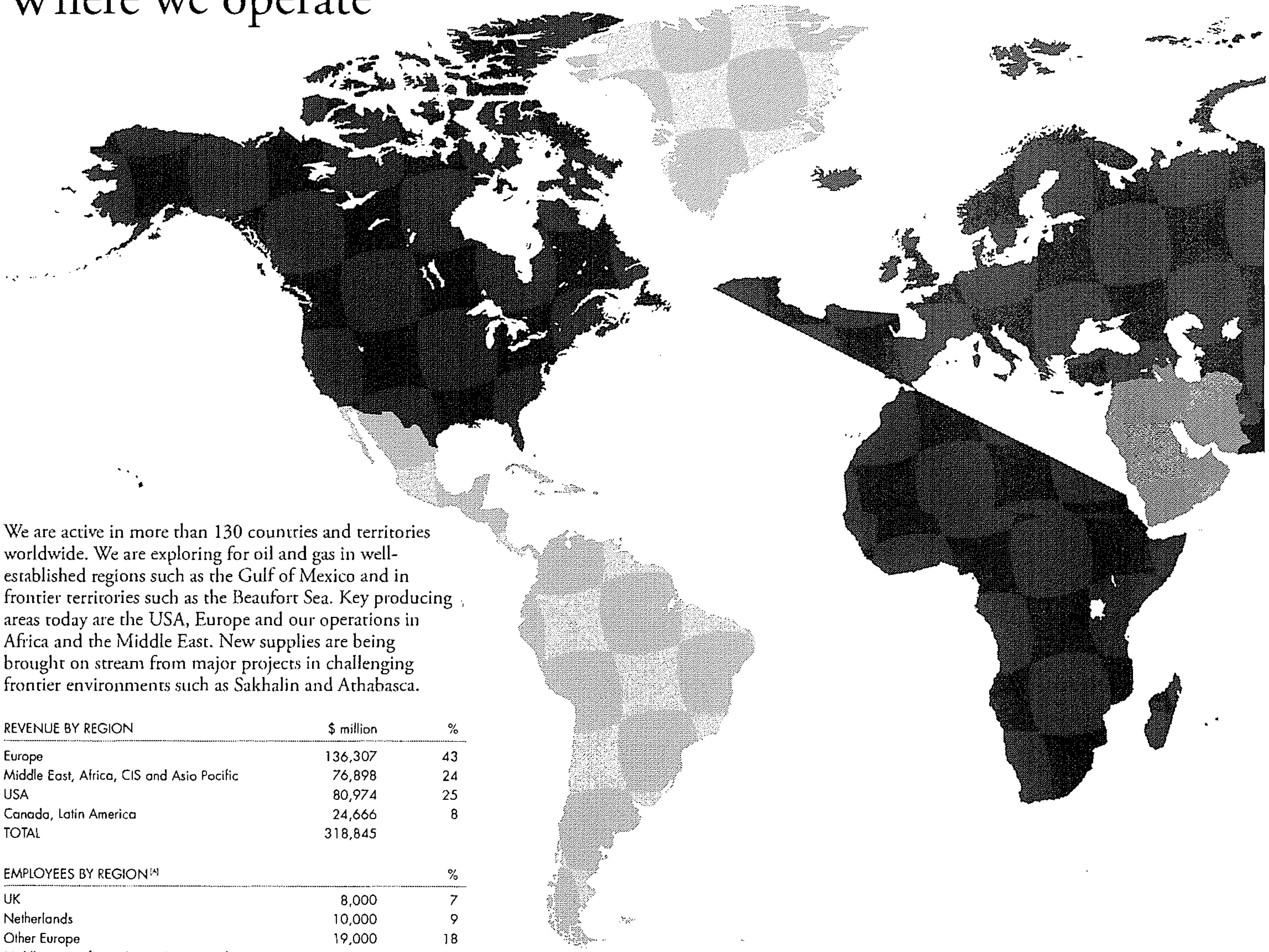
Income by industry segment — $ million

	2006
Exploration & Production	15,195
Gas & Power	2,650
Oil Products	7,125
Chemicals	1,064
Other industry segments and Corporate	277
Income for the period	26,311

Percentage by industry segment — %

2006	Revenue	Income	Employees
Exploration & Production	6%	58%	18%
Gas & Power	5%	10%	3%
Oil Products	78%	27%	62%
Chemicals	11%	4%	6%
Other industry segments and Corporate	–	1%	11%

Where we operate



We are active in more than 130 countries and territories worldwide. We are exploring for oil and gas in well-established regions such as the Gulf of Mexico and in frontier territories such as the Beaufort Sea. Key producing areas today are the USA, Europe and our operations in Africa and the Middle East. New supplies are being brought on stream from major projects in challenging frontier environments such as Sakhalin and Athabasca.

REVENUE BY REGION	$ million	%
Europe	136,307	43
Middle East, Africa, CIS and Asia Pacific	76,898	24
USA	80,974	25
Canada, Latin America	24,666	8
TOTAL	318,845	

EMPLOYEES BY REGION[A]		%
UK	8,000	7
Netherlands	10,000	9
Other Europe	19,000	18
Middle East, Africa, CIS and Asia Pacific	35,000	33
USA	24,000	22
Canada, Latin America	12,000	11
TOTAL	108,000	

[A] Average numbers, rounded to nearest thousand.

NORTH AMERICA	
Canada	▲△▼▽●
USA	▲△▼▽●

SOUTH AMERICA	
Argentina	▲ ▼▽
Bolivia	△
Brazil	▲△▼▽
Chile	▼▽
Colombia	▼▽
Costa Rica	▼
Ecuador	▼
El Salvador	▼
Guatemala	▼
Honduras	▼
Mexico	△▼▽
Nicaragua	▼
Panama	▼
Peru	▼
Surinam	▼
Venezuela	▲ ▼▽

THE CARIBBEAN	
Antigua & Barbuda	▼
Bahamas	▼
Barbados	▼
Dominican Republic	▼
French Antilles & Guiana	▼
Puerto Rico	▼▽
St. Kitts & Nevis	▼
St. Lucia	▼
St. Vincent	▼
Trinidad & Tobago	▼

EUROPE			
Austria	▲ ▼	Lithuania	▼
Belgium	▼	Luxembourg	▼ ●
Bulgaria	▼	Montenegro	▼
Croatia	▼	Netherlands	▲△▼▽●
Czech Republic	▼	Norway	▲△▼
Denmark	▲△▼▽	Poland	▼▽
Estonia	▼	Portugal	▼
Finland	▼	Romania	▼
France	▼▽●	Serbia	▼
Germany	▲△▼▽●	Slovakia	▼
Gibraltar	▼	Slovenia	▼
Greece	△▼▽	Spain	△▼▽●
Hungary	▼	Sweden	▼
Iceland	●	Switzerland	▼▽
Ireland	▲ ▼	Turkey	△▼▽
Italy	▲△▼▽	UK	▲△▼▽●
Latvia	▼		

AFRICA			
Algeria	▲△▼	Lesotho	▼
Angola	▲	Libya	▲△
Benin	▼	Madagascar	▼
Botswana	▼	Mali	▼
Burkina Faso	▼	Morocco	▼
Cameroon	▲	Mozambique	▼
Cape Verde Islands	▼	Namibia	▼
Democratic Republic of Congo	▼	Nigeria	▲△▼
Cote d'Ivoire	▼	La Réunion	▼
Djibouti	▼	Senegal	▼
Egypt	▲△▼	South Africa	▼▽
Ethiopia	▼	Sudan	▼
Gabon	▲ ▼	Swaziland	▼
Gambia	▼	Tanzania	▼
Ghana	△▼	Togo	▼
Guinea	▼	Tunisia	▲ ▼
Kenya	▼▽	Uganda	▼
		Zimbabwe	▼

KEY:

UPSTREAM	DOWNSTREAM	OTHER
▲ Exploration & Production	▼ Oil Products	● Renewables and Hydrogen
△ Gas & Power	▽ Chemicals	

Over time and across the commodity cycle Shell has achieved higher earnings and returns on investment in the upstream compared with its other businesses and sees significant growth potential for oil and natural gas. Our upstream business will therefore be the focus for future growth. In the downstream the emphasis will be on sustained cash generation and on continuing to reshape our portfolio with a focus on the growing markets of Asia Pacific.

Our strategy of more upstream and profitable downstream will reinforce our position as a leader in the industry and provide investors with a competitive and sustained total shareholder return. We plan net capital[B] spending of $22 to $23 billion in 2007, of which around 80% will be invested in upstream projects. This investment will help create an upstream portfolio of assets that will have long, productive lives. These investments will be in both conventional and unconventional hydrocarbon projects. Our capital programme will also maintain and enhance our competitive position in the downstream by improving the quality, integrity and competitiveness of our refinery portfolio and by developing our presence in growth markets.

Providing more energy while minimising the environmental impact is a major challenge for the global energy industry and society as a whole. We are pursuing a range of potential opportunities to develop businesses based on alternative energies. We also recognise the importance of CO_2 management to our business and the opportunities it represents. We are developing responsible ways to manage carbon dioxide, including CO_2 sequestration projects and energy efficiency.

A commitment to technology and innovation continues to be at the heart of our business strategy. We believe our technological expertise will be a key factor in the growth of our business as energy projects become more complex and technically demanding. The Group's core strengths include the development and application of technology and the financial and project management skills that allow us to undertake large oil and gas projects. We also benefit from having a diverse international business portfolio and customer-focused businesses built around the strength of the Shell brand. Our ability to manage large and challenging projects in conventional and unconventional oil and gas, to find ways of managing CO_2 emissions, and to provide alternative energy solutions means we are well placed to be preferred partners for governments and other resource holders, now and in the future.

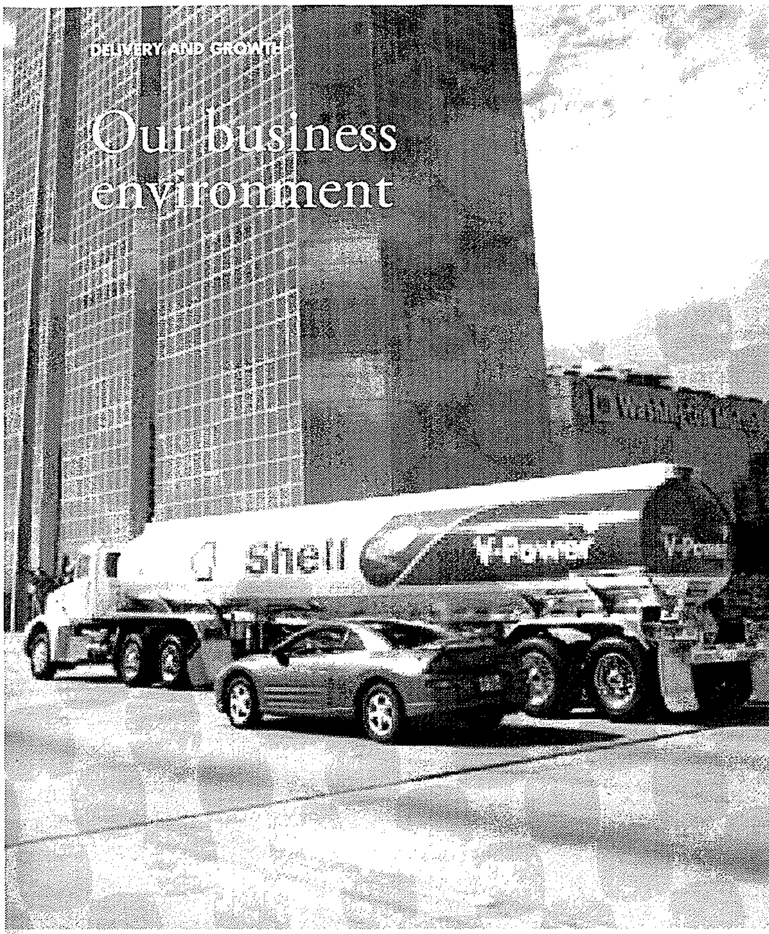
[B] Net capital spending represents the expected capital expenditure after including cash received from divestments as well as cash utilised in relation to acquisitions.

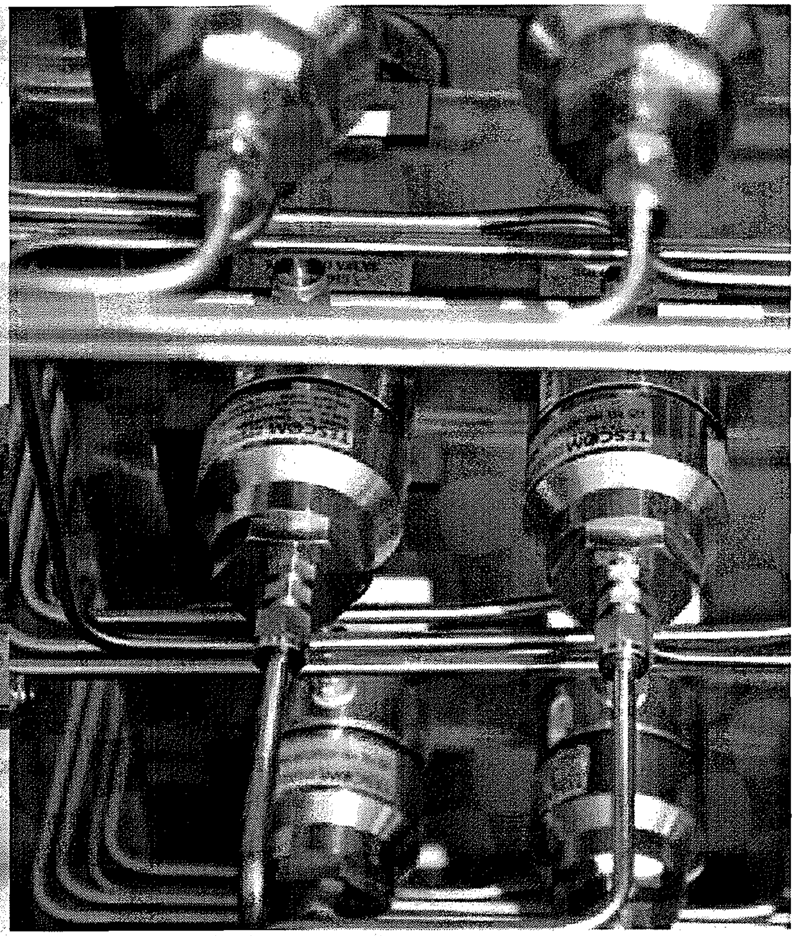
MIDDLE EAST					
Iran	▲	△	▼		
Oman	▲	△	▼		
Qatar	▲	△	▼		
Saudi Arabia	▲		▼	▽	
Syria	▲				
United Arab Emirates	▲	△	▼	▽	
Yemen			▼		

COMMONWEALTH OF INDEPENDENT STATES					
Azerbaijan	▲				
Kazakhstan	▲				
Russia	▲	△	▼		
Ukraine	▲	△	▼		

ASIA PACIFIC					
Australia	▲	△	▼	▽	
Brunei	▲	△	▼		
China (includes Hong Kong)	▲	△	▼	▽	●
Fiji			▼		
Guam			▼		
India		△	▼		●
Indonesia	▲		▼		●
Japan		△	▼	▽	●
Laos			▼		
Malaysia	▲	△	▼	▽	
Mauritius			▼		
New Zealand	▲		▼	▽	
Pakistan	▲		▼		
Philippines	▲		▼	▽	●
Singapore		△	▼	▽	●
South Korea		△	▼	▽	
Sri Lanka			▼		●
Taiwan			▼	▽	
Thailand			▼	▽	
Vietnam			▼	▽	

Our business environment





We have a strong resource base and are investing more than ever to find and produce additional oil and natural gas.

Our innovative technology allows us to operate in challenging frontier environments and continually improve the efficiency of our operations.

Shell has a profitable downstream business with the world's largest single branded retail network and one of the world's most powerful brands.

We are building on our successful track record in liquefied natural gas across the whole production chain and are a leading LNG supplier.

We believe we are the world's largest distributor of biofuels and we are one of the biggest developers of wind energy.

We see our future business environment as one where:

Oil, gas and coal will continue to meet most of the world's energy needs.

More oil will be produced from unconventional resources, such as oil sands.

Managing the environmental and social impact of energy use and production will remain a priority.

Partnership with governments and national oil companies will play a key role.

The global economy expanded by 5.4% in 2006, up from 4.8% in 2005, supported by strong activity in China, India and Russia. While growth in the USA also started the year on a firm note, the economy slowed in the course of the year due to a sharp slowdown in the housing sector. However, consumer spending and business investment remained firm and underpinned growth. The European economy strengthened significantly in 2006, and that looks set to continue with solid growth according to the European Central Bank. In contrast, consumer spending in Japan slowed. Nevertheless exports and business investment remained strong, and this points to a stronger 2007. China and India saw particularly robust growth in 2006. In China, business investments and exports drove growth, while in India it was domestic demand and the services sector. Both countries are expected to see continued growth in 2007, but at a lower level than in recent times.

Oil prices increased in 2006 due to a combination of strong world economic growth, supply disruptions, geopolitical tensions in the Middle East, and limited OPEC spare production capacity. Brent crude oil prices averaged $65.10 per barrel in 2006 compared with $54.55 in 2005, while West Texas Intermediate (WTI) prices averaged $66.04 per barrel compared with $56.60 a year earlier.

Oil prices are on balance expected to remain robust in 2007 as a result of ongoing geopolitical tensions. However, the trend may be lower than in 2006 if there is slower economic growth, a stronger increase in non-OPEC supply, higher OPEC spare capacity and no major disruption to supply. In the medium- to long-term, the Group anticipates prices will moderate from present levels, because both supply and demand are expected to respond to higher prices, and OPEC spare capacity will be rebuilt.

Henry Hub gas prices in the USA averaged $6.76 per million British thermal units (Btu) in 2006 compared with $8.80 in 2005. Natural gas prices in continental Europe and Asia Pacific are predominantly indexed to oil prices and in 2006 prices rose in Europe, reflecting higher oil prices and strong demand.

In 2006 refining margins remained well supported, with robust growth in product demand and supply constraints due to unusually intense industry turnaround activity following the hurricanes on the US Gulf Coast in 2005. In the absence of any major disruptions, refining margins are expected to trend lower in 2007 than 2006 with new conversion capacities coming on stream and the prospect for potentially slower economic growth. However, the eventual levels are uncertain and will be strongly influenced by the pace of global economic growth, the effect of persistently high oil prices on product demand and start-up timing of expected refinery expansion.

Demand for petrochemicals in 2007 is expected to increase in tandem with global economic growth, mainly in Asia Pacific. However, the addition of new capacity, coupled with the prospect of continued high feedstock and energy costs, may limit the opportunities for margins to improve.

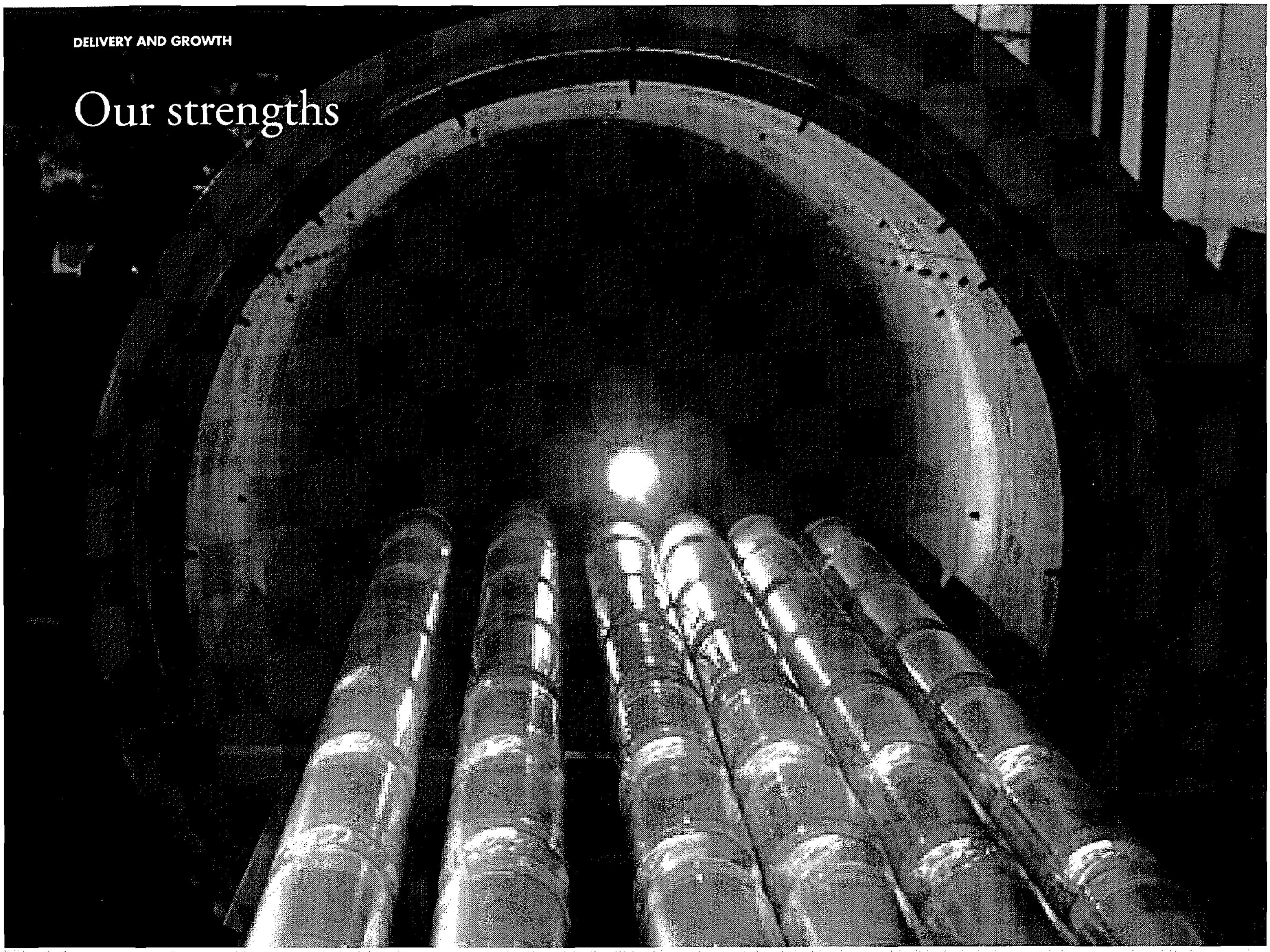
As the world's population expands and economies grow, energy demand is expected to rise rapidly. By 2050, global energy needs could more than double. The challenge is to meet increased demand for secure, affordable energy in an environmentally and socially responsible way.

Part of the answer is to develop a broad array of traditional and alternative energy sources. Fossil fuels, including coal, currently meet about 80% of the world's energy needs – and they are likely to stay the most affordable and accessible source of energy for the coming decades. Alternatives to fossil fuels, such as wind and solar power, will meet an increasing part of the world's energy needs over the next 30 years. But demand for oil and gas will also continue to rise. With the age of easily accessible oil at an end, meeting growing demand will mean energy companies take on more technically complex projects – while continuing to manage their political, environmental and social effects.

Shell is investing more than ever in finding and producing new resources. We are making significant investment in new technology and in ensuring we have skilled people in place to apply it. We have chosen to work across a broad energy mix, including conventional oil and gas, gas-to-liquids (GTL), unconventional oil and alternative energy. We are successfully exploring in ever-deeper water, expanding our liquefied natural gas business and developing unconventional resources such as oil sands.

A crucial part of the environmental challenge is managing the greenhouse gas emissions linked to climate change, even while we grow our business. We continue to work towards meeting our own demanding target to reduce emissions from Shell's operations. We also play a lead role in demonstrating ways to manage carbon dioxide (CO_2) responsibly. However, we also recognise that the challenge of climate change cannot be addressed by one company or the energy industry alone. Governments will need to support public-private partnerships, create a strong policy framework and provide incentives for investment in order to make CO_2 mitigation viable on a large scale.

Our strengths



We held the first Shell Science Symposium and published the first Shell Technology Report.

Snake well and Smart Fields® technology helped raise production in Brunei to a 25-year record.

4D seismic technology discovered substantial remaining oil in areas in the North Sea that had not yet been tapped.

Shell began construction of the world's largest gas-to-liquids plant in Qatar.

An Audi R10 TDI powered by a specially formulated blend of Shell's GTL fuel and V-Power* diesel was the first diesel car to win the Le Mans 24-hour race.

Shell's swellable elastomer technology made extra production possible in Oman.

Shell and Statoil of Norway joined forces to work on the potential development of the world's largest project using CO_2 for enhanced oil recovery offshore.

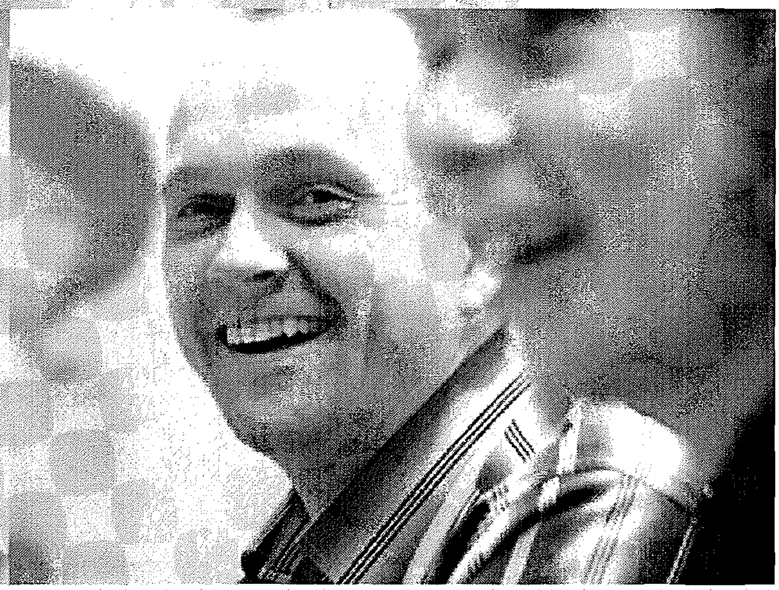
Technology is increasingly important in addressing the energy challenge. Shell has always been at the forefront of innovations in technology, developing techniques to find and produce new energy resources. In 2006, Shell increased investment in technology and appointed a Group Chief Technology Officer to strengthen our strategic approach and reinforce our development and use of new technologies.

Technology developed and applied by Shell helps us to produce oil and gas in increasingly remote regions of the world and in greater depths of water. Our advanced seismic and drilling techniques enable us to find new oil and gas in complex geological formations. We are also working to improve production from existing wells. We employ advanced computer technology to continuously monitor wells, which helps us respond rapidly to changing reservoir conditions and maximise production. New production techniques are unlocking the potential of unconventional resources such as oil sands and oil shale. Technology is also vital in reducing the environmental impact of energy production and usage. We are producing and marketing cleaner fuels such as gas-to-liquids (GTL) and biofuels, and are working with vehicle manufacturers to develop more efficient fuels and engines. Shell is also researching several options to capture and store CO_2.

Commercially viable renewable energy also depends on new technology. We are developing ways to lower the cost of solar panels and make wind power more widely available.

Technology is, and always has been, a fundamental force driving Shell's products, production methods and people. It will help us deliver growth across all Shell's businesses in 2007 and beyond.



Skilled and experienced people are essential to our ability to complete tomorrow's complex energy projects. We are working hard to ensure that we attract and retain the people we need to develop our future business. We undertook a range of initiatives in 2006 including a successful recruitment process which led to nearly 6,000 people joining Shell, three-quarters of them experienced professionals. We also set up a new technology centre in Bangalore to attract talented workers in India, and continued to develop a range of links with academic and training institutions around the world.

A key strength of our workforce is its diversity. Women, for example, make up 27% of all our hires, and 28% of recruits for technical roles. We continue to develop initiatives to provide all members of our staff with the opportunities to develop their skills and reach their full potential.

Shell aims for consistently high standards in developing and starting up energy projects. Yet as the need to explore and produce hydrocarbons in ever-more remote or hostile environments grows, projects are becoming increasingly complex and challenging. They demand the use of new technologies and the skills to meet environmental and social challenges. Shell employees must develop their project management skills and have access to the best practice and latest technology from around the world.

That is why Shell set up its Project Academy. The academy provides training and development for employees involved at all stages of projects, from the initial planning stage to operations. It provides a wide range of opportunities including coaching and mentoring, online ways of sharing knowledge and best practice, and formal learning and accreditation. During 2006 more than a thousand Shell staff took part in academy events.

Shell has chosen four university partners to help develop the curriculum and complement Shell's own project management expertise. These are the Cranfield School of Management, Delft University of Technology, University of Texas at Austin/McCombs School of Business and Queensland University of Technology. Each has project management expertise and experience that will reinforce the academy's work by broadening the learning and development it offers.

Shell believes the opportunities offered by the Project Academy will help us recruit and retain the leading project managers in the industry. They will allow us to continue delivering complex energy projects on schedule and within budget.

Our accomplishments

In 2006, we focused on delivery and growth, laying solid foundations for our future.

GROWTH IN CHINA

The Nanhai petrochemicals complex in southern China started production early in 2006. It is one of the biggest and most sophisticated petrochemicals projects Shell has been involved in – and represents one of Shell's largest single investments in petrochemicals. The $4.3 billion development, a 50:50 joint venture with Chinese company CNOOC, employs 1,500 people, 95% of them locals.

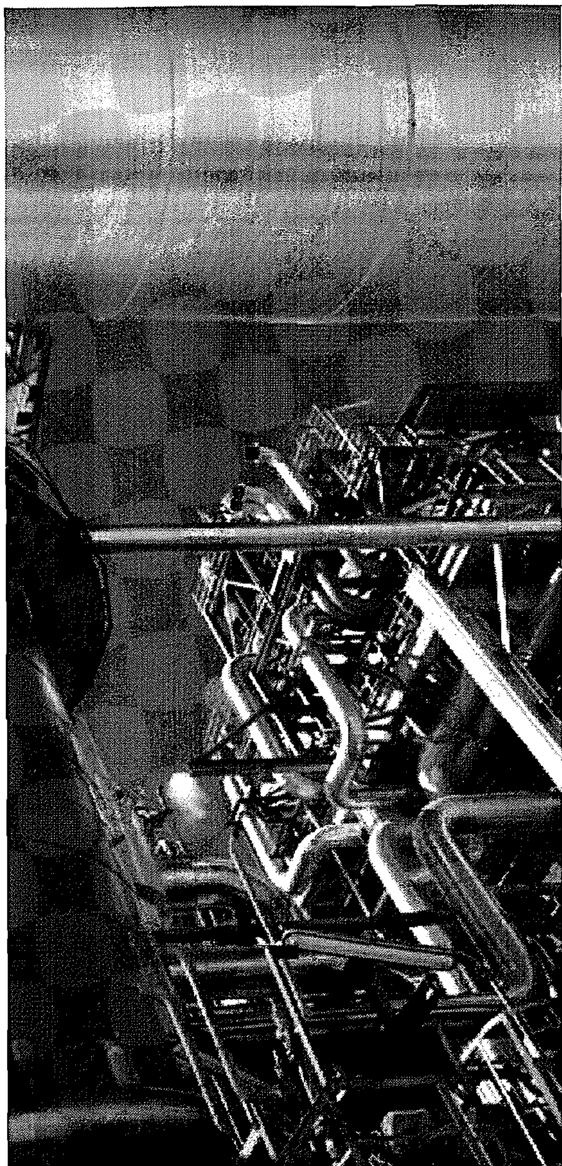
The complex, which was completed on time and on budget, is located in Guangdong province, about 80 kilometres north-east of Hong Kong. Its facilities draw on some of the world's most advanced technology, capable of processing a wider variety of feedstock than most plants in China.

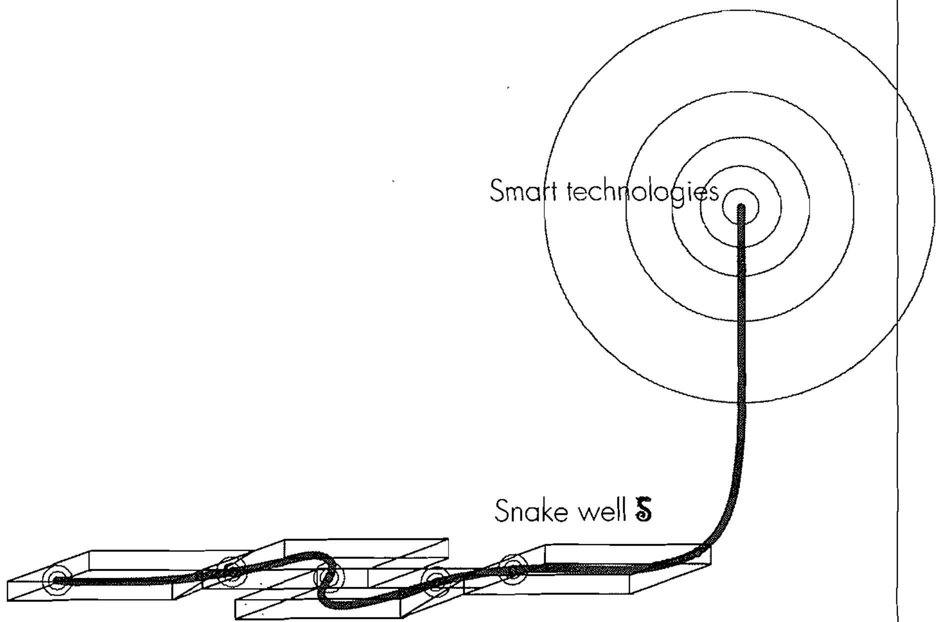
Its environmental standards are also world-class. Sustainable development was central to the project from the start, with a comprehensive environmental and social impact assessment that was based on consultations with local communities, governments and non-governmental organisations.

Nanhai's 2.3 million tonnes a year of petrochemical products – for use in products from plastics and packaging to textiles and foam – will help meet growing demand for fibres, plastics and petrochemicals in China.

A key feature of Nanhai's development has been tailoring products closely to the needs of Chinese businesses. This included setting up a network of distributors and regional storage terminals, as well as road and shipping contracts. As a result, the plant has very quickly secured customers and a strong market presence.

The Nanhai joint venture is central to the growth plans of Shell Chemicals and places Shell at the centre of the fastest-growing market in the world. By 2010 China is expected to account for about 20% of global demand for base petrochemicals.





SMART FIELDS AND SNAKE WELLS

The latest development of the Champion West field shows how new technology can unlock oil and gas resources previously thought too hard or too costly to access. Production from the third phase of development of this field started in early 2006, ahead of schedule. Lying 90 kilometres off Brunei, this field holds some of the area's richest potential resources and is expected to produce oil and gas for at least 20 years.

Yet for nearly three decades Champion West's resources remained seemingly beyond reach, locked in a series of unconnected reservoirs in varying geological structures. Such resources were previously seen as inaccessible or too expensive to tap individually. Shell's snake wells drilling technique was among the new technologies which made development of such complex fields possible. Unlike conventional horizontal wells, snake wells undulate and turn corners to link pockets of hydrocarbons spread over large distances and at different depths. Snake well technology allows each reservoir to be tapped either individually or in combination.

Shell's Smart Fields® technology is another key feature of the Champion West development. Digital information technology and a range of sensors in the wells allows us to remotely monitor operating conditions such as flow, temperatures and pressure in real time. Such round-the-clock monitoring significantly boosts production efficiency and helps maximise the amount of oil and gas that can be recovered. Engineers can activate underground valves electronically to solve problems and manage production. Champion West is one of the most technically advanced offshore fields in the world.

Further expansion of the field is planned to bring a number of gas wells into production. By the end of the decade almost a quarter of Brunei Shell Petroleum's gas production is expected to come from this field.

FUTURE FUELS

Shell has more than a century of experience in developing new transport fuels and marketing them successfully to customers. Today we are investing in the technology and innovation needed to help us become a leading provider of the next generation of fuels. These range from advanced diesel and petrol, to synthetic fuel produced from the gas-to-liquids process, to second-generation biofuels and hydrogen.

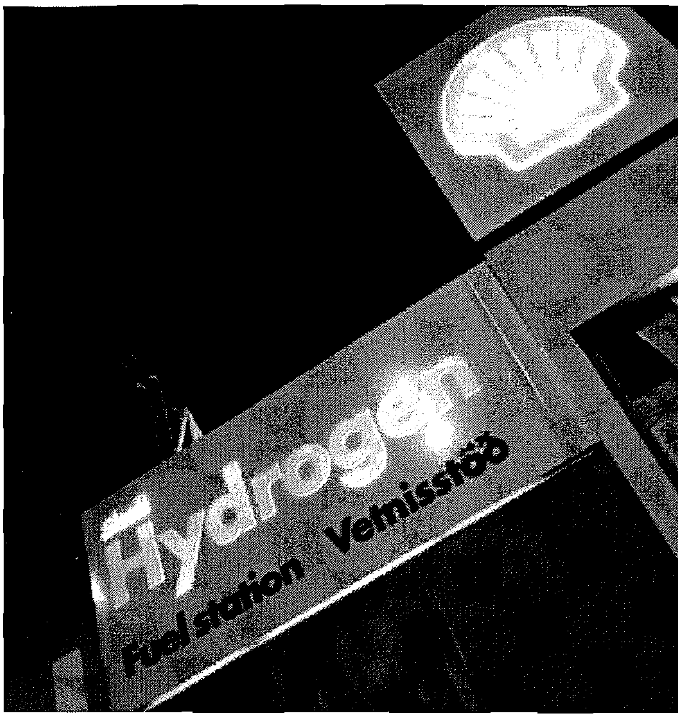
Gasoline and diesel will remain affordable, practical solutions to the world's transport needs for many years to come. Shell has developed a range of advanced fuels that improve engine and fuel efficiency, lowering local emissions. We continue to work in technical partnership with vehicle manufacturers to develop fuels in line with engine development and to reduce emissions still further by improving efficiency.

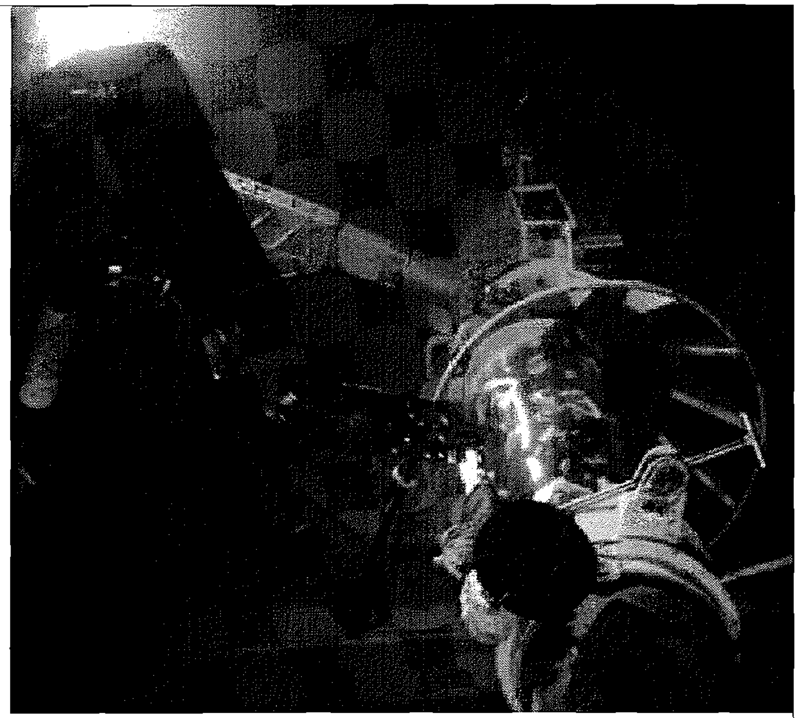
Shell's Gas to Liquids (GTL) technology produces a high-performance synthetic transport fuel from natural gas which can be used in diesel engines. It produces fewer local emissions of carbon monoxide and unburnt exhaust particles than conventional diesel, helping to tackle air pollution in urban areas. Its benefits have been shown in a number of trials. In June 2006, an Audi R10 TDI powered by a GTL-diesel blend produced from Shell's V-Power® diesel technology won the Le Mans 24 hour race. It was the first time a diesel-powered car had won the event, one of the world's toughest endurance races. Shell's GTL-diesel blends are available across Europe.

Shell took a major step forward in 2006 with the decision to begin construction on the Pearl GTL project in Qatar. When complete, Pearl will produce 140,000 barrels per day of GTL products and 120,000 barrels of oil equivalent per day of condensate, liquefied petroleum gas and ethane.

Shell is a leading distributor of first-generation biofuels made from plants. But we are investing in companies developing second-generation biofuels produced from straw or woodchips, which do not compete with food crops. These fuels can produce less carbon dioxide on a life-cycle basis than first-generation biofuels and fossil fuels. Shell is working with Iogen, a Canadian company, to make a second-generation biofuel known as cellulose ethanol from straw. We are also working with CHOREN Industries, of Germany, to convert biomass such as woodchips into a fuel identical to GTL, with a similar reduction in local emissions.

We continue to explore ways of developing hydrogen as a viable transport fuel.





ALTERNATIVE ENERGY

Producing sustainable energy is at the heart of Shell's business. Today we have one of the broadest renewable energy portfolios of any major energy company: biofuels and hydrogen in transport, wind and solar for electricity. We aim to develop a substantial business in at least one alternative energy technology. To achieve this we continue to seek ways of making such technologies cost effective.

We are one of the leading distributors of first-generation biofuels and are focusing on developing a second generation made from waste plant matter. Second-generation biofuels can reduce carbon dioxide emissions from transport fuels and fit closely with Shell's existing business.

Shell is one of the world's largest developers of wind energy. In 2006 we invested in a major new project at Mount Storm in West Virginia, USA. Shell's first offshore wind farm, Offshore Windpark Egmond aan Zee, off the Dutch coast, began producing electricity from 36 turbines with a capacity of 108 megawatts (Shell interest 50%), enough to power more than 100,000 homes. We are involved in the potential development of the 1,000 megawatts London Array Project. If permits are received and the project is executed, it could be the world's largest wind farm. We are also exploring possible projects in China.

Our interests in solar power took a step forward during the year when we joined with glassmaker Saint-Gobain to develop next-generation CIS thin-film solar panels. In November the joint venture, AVANCIS GmbH, began building a 20 megawatts plant in Germany to manufacture thin-film panels, a technology we believe will drive down costs and unlock the potential of solar power.

Hydrogen is another potential source of cleaner energy. Shell is investing in research and development which aims to make hydrogen a safe, efficient and practical alternative fuel. We have demonstration projects in Asia, North America and Europe and we are working on ways of expanding retail outlets. In 2006 Shell announced plans to help create the world's largest hydrogen public transport project in Rotterdam.

CLEANING UP AFTER KATRINA

Hurricane Katrina damaged a number of Shell's production facilities in the Gulf of Mexico in 2005. All were brought back into operation by the end of that year – except the worst-hit platform, Mars. It lies 200 kilometres south-east of New Orleans and accounts for about 5% of the daily production from the Gulf of Mexico. For around four hours it was battered by 25-metre waves and winds gusting at more than 300 kilometres an hour. The platform drilling rig and the underwater pipelines were seriously damaged.

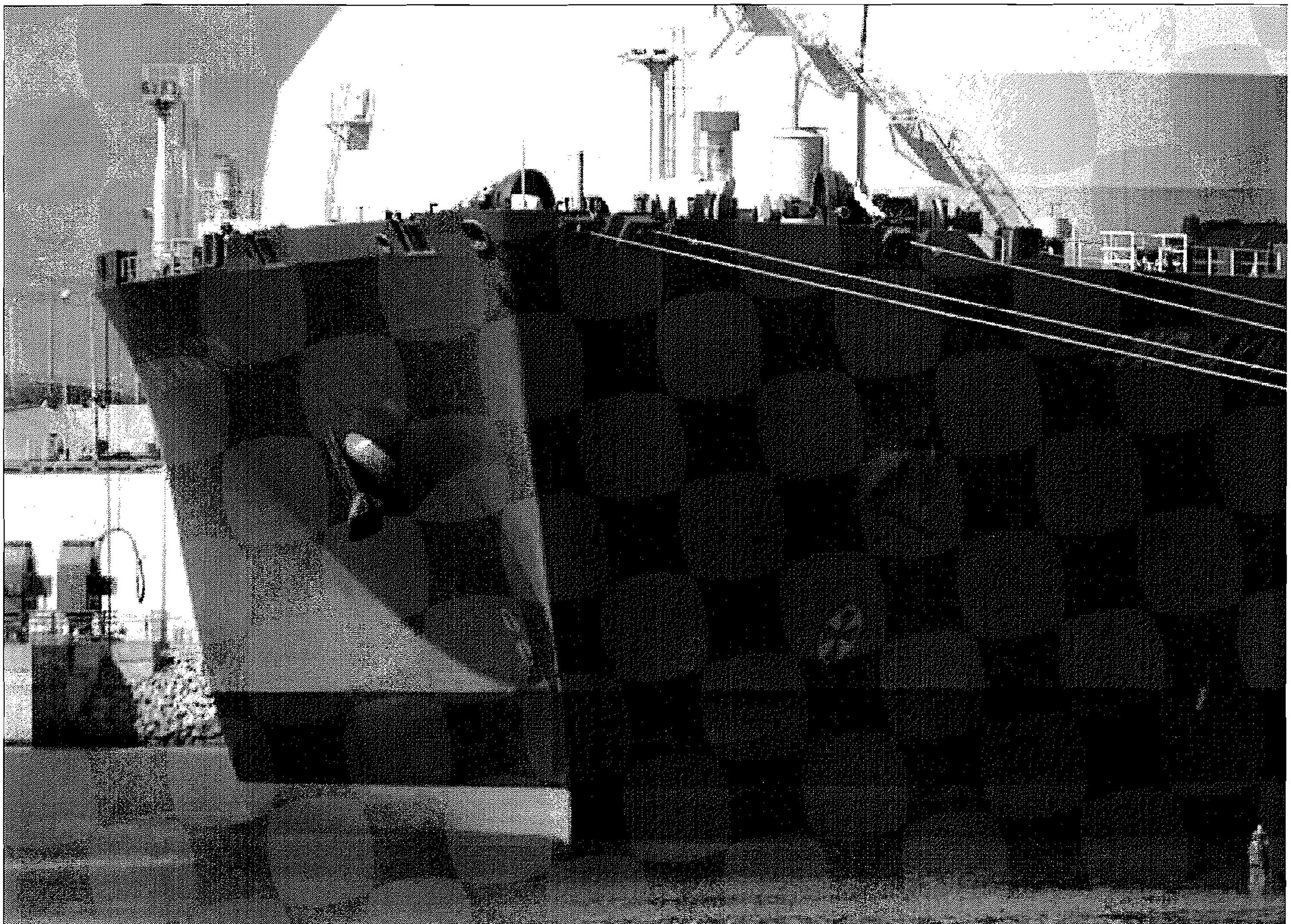
Repairs began in early 2006 and involved some of the most technologically complex operations ever carried out in the energy industry. It took three months of preparation and planning before the wrecked drilling rig could be lifted from where it had fallen on the platform deck. Raising this tangled steel structure of more than 600 tonnes, without further damaging the other facilities and processing equipment, was a major challenge. But we succeeded and the damaged sections were taken ashore to be repaired.

Another major engineering feat was the repair of the oil and gas pipelines lying in 800 metres of water, using remote-controlled tools. Being able to repair the pipelines on the seabed meant the process could be carried out much more rapidly than using more traditional methods where the pipelines are lifted out of position.

More than 500 people, working a total of one million accident-free man-hours, carried out the repairs. The work was completed ahead of schedule in May 2006. By the end of the year the Mars field was producing over 20% more oil than it was before the hurricane.

RETURN TO NEW ORLEANS

Shell staff showed bravery, commitment and resourcefulness in repairing the damage caused by hurricane Katrina across our operations in the Gulf of Mexico. Thanks to their efforts, our offshore platforms, retail sites, refineries and chemical plants went back into operation remarkably quickly. One of the most poignant events was the reopening in February of Shell's main offices in central New Orleans, five months after the hurricane. The return of a thousand employees – the first 250 in an emotional public celebration featuring music and employees sporting "Shell is Home" tee-shirts – demonstrated Shell's commitment to the city and our contribution to its economic recovery.



EXPANSION OF LNG PRODUCTION IN NIGERIA

Shell has played a major part in the development and growth of Nigeria's LNG industry. We have a 25.6% stake in the Nigeria LNG (NLNG) plant at Bonny Island. The plant has grown rapidly since its start-up in 1999 and is now seeing further significant expansion. Two new trains – the units which liquefy natural gas – started production around the beginning of 2006. This means the Bonny Island plant now has five trains with a total production capacity of more than 17 million tonnes of LNG a year. Shell's LNG project management expertise and advanced technology helped ensure that both trains were completed within budget.

Further expansion of the plant is under way with a sixth train expected to start production within the next year. When complete it will enable NLNG to ship around 350 cargoes a year to European and US markets. Planning is now under way for a seventh train that could increase production capacity to 30 million tonnes a year early in the next decade.

The Bonny Island plant supplies a range of markets, including North America where demand for clean-burning natural gas is growing. Cargoes from Nigeria are sent to Lake Charles in the USA and to the new Altamira terminal in Mexico. The plant has also been supplying the European market for many years and has secured new customers in the UK, Spain and Italy.

Nigeria's significant gas reserves mean that by early next decade it could be the world's second-largest LNG producer, behind Qatar.

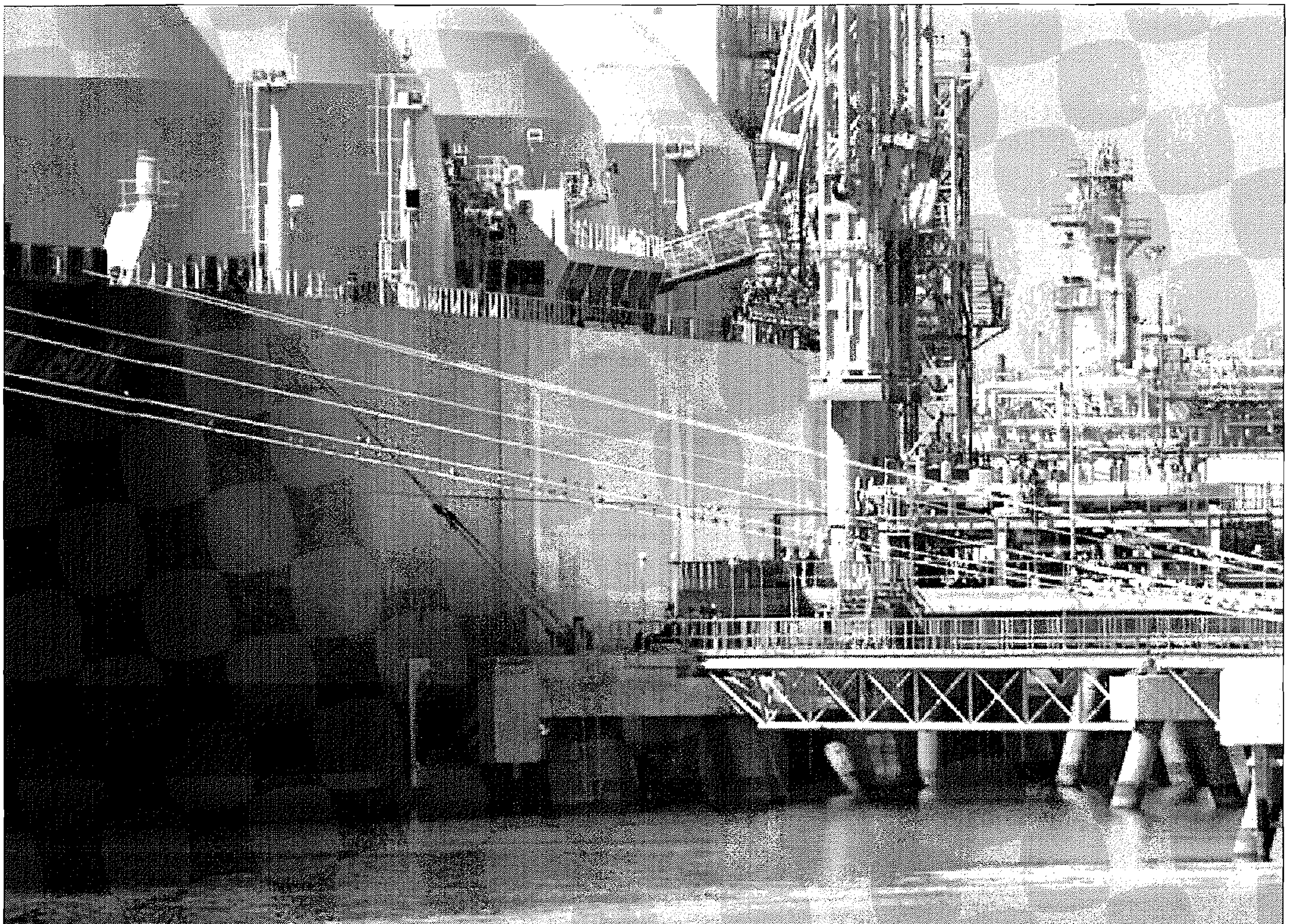
LNG ARRIVES IN MEXICO

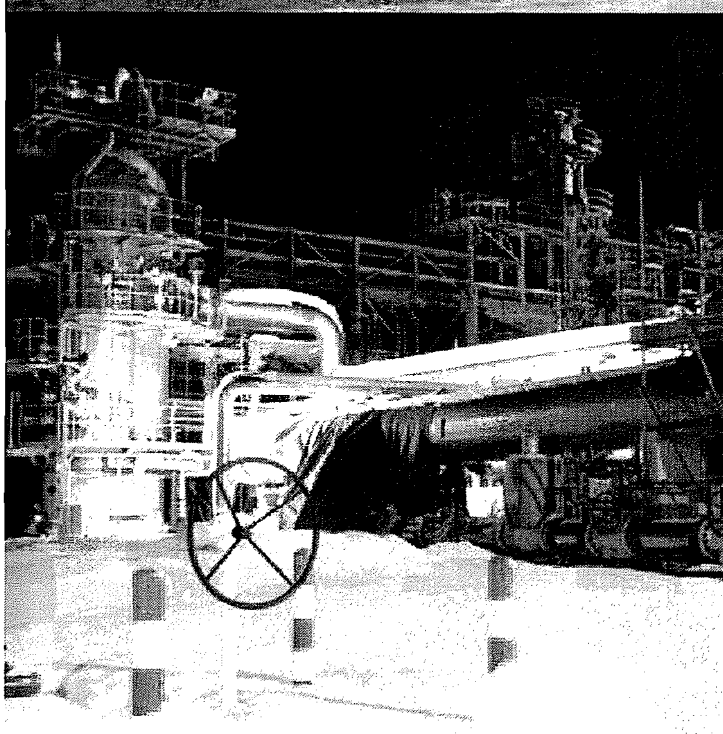
Mexico's first LNG shipment arrived at the Altamira regasification terminal in August 2006 from the Bonny Island plant in Nigeria. The LNG terminal, located on Mexico's northern Gulf Coast, is a joint venture between Shell, Total and Mitsui. Construction took less than three years from the decision to go ahead to the start of operations.

Shell holds rights to 75% of the terminal's capacity. Ships with a capacity of up to 205,000 cubic metres can unload there. Each of the terminal's two storage tanks contains up to 150,000 cubic metres of LNG and the regasification facilities themselves can send out 760 million cubic feet of gas a day.

The terminal boosts Mexico's energy supplies at a time when the country is looking to increase energy resources. The country's power authority has signed a contract to purchase 3.92 million tonnes of LNG a year from Altamira over the next 15 years. The terminal, which supplies only the Mexican market, has the potential to expand cost-effectively to meet growth in future demand. Shell also holds 50% capacity rights in another LNG terminal on Mexico's Pacific coast in Baja California, which is expected to start operations in 2008.

The successful start-up of the Altamira terminal places Shell at the heart of a market with significant potential for growth. It underlines Shell's successful record of delivering LNG facilities on time and on budget. It also demonstrates our expertise, from exploration and production to final delivery of natural gas to customers. The environment benefits too, because gas-fired power stations produce significantly less carbon dioxide and local emissions than conventional coal-fired plants.





PROGRESS IN SAKHALIN

The Sakhalin project took major steps forward. By the end of 2006 construction was more than 80% complete. More than 20,000 people were working on the development and over $8 billion-worth of contracts had been awarded to Russian contractors.

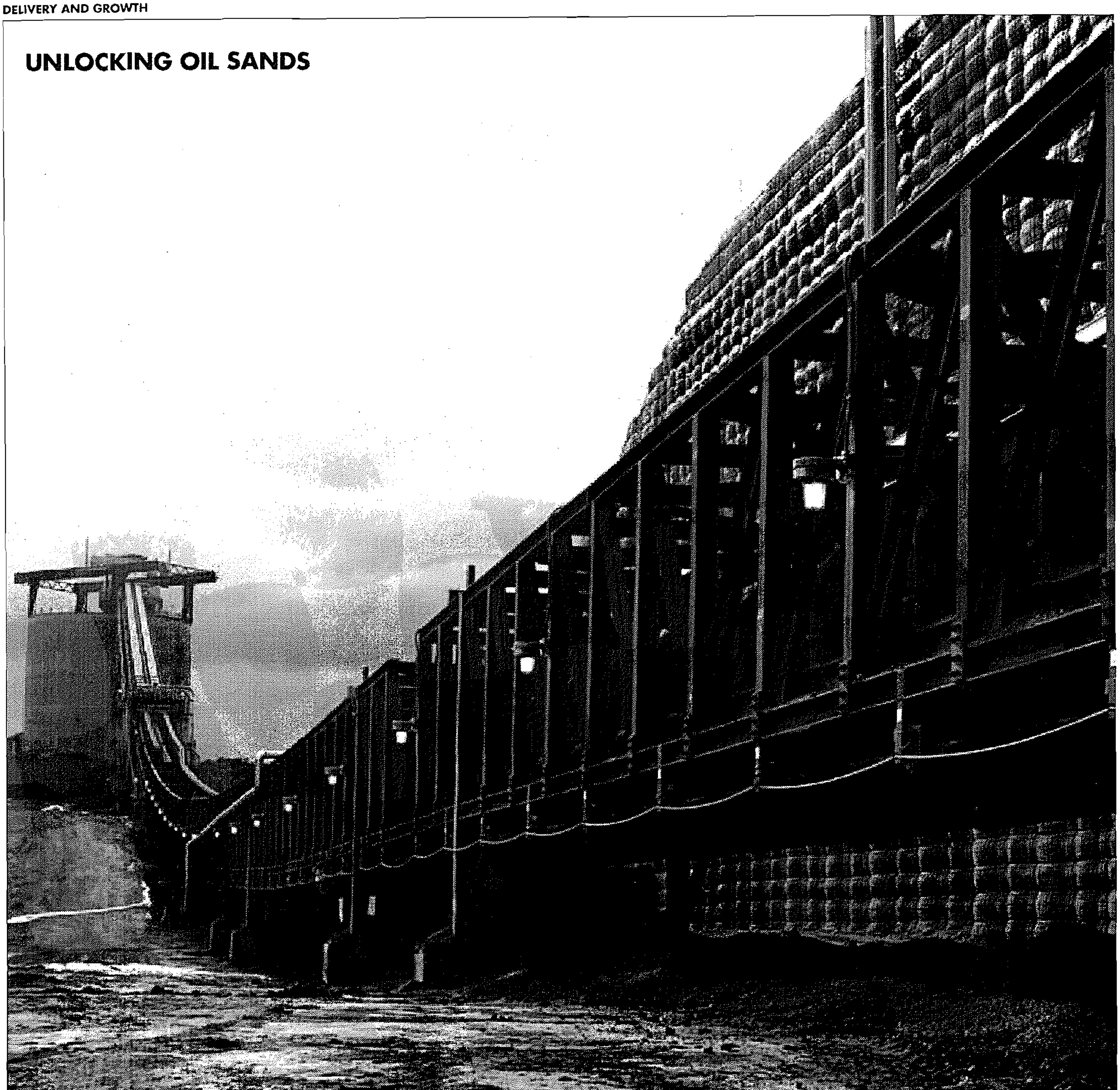
Demand for Sakhalin's LNG continued to grow. Contracts for a further 1.4 million tonnes were signed with customers during the year, meaning 98% of the long-term capacity of the LNG plant had been sold by year end.

In an unprecedented operation the Lunskoye-A gas production platform was installed off the coast of Sakhalin Island. A fleet of tugs towed the 22,000-tonne platform nearly 3,000 kilometres from the construction yard in South Korea. The platform is a base for more than 100 people and is designed to withstand earth tremors and extreme conditions such as pressure from winter ice. Drilling is expected to start in 2007.

Another significant step was the completion of the jetty where the LNG will be loaded onto tankers. The ships will have a capacity of up to 145,000 cubic metres and will take between six and 16 hours to load. The installation of onshore pipelines also continued, with a range of environmental protection measures put in place to manage the process, including monitoring by independent experts. Construction of the LNG plant, which will have an annual production capacity of 9.6 million tonnes, is on track for deliveries to begin in the second half of 2008.

In December 2006, the partners in Sakhalin Energy, of which Shell owns 55%, signed a protocol to sell half of their shares to Gazprom, clearing the way for possible expansion, as well as further exploration opportunities around Sakhalin Island. The partners also reached agreement with the Russian government on the project's amended budget.

UNLOCKING OIL SANDS



As the era of easy oil ends, new resources must be developed to meet the world's growing need for energy. We expect oil and gas extracted from unconventional sources, such as oil sands, to grow as we develop new technologies and explore new opportunities.

The Athabasca Oil Sands Project, a joint venture in which Shell Canada holds 60%, began operations in 2003.

A 100,000-barrels-a-day expansion began late in 2006. This is the first of several planned expansions towards a long-term production goal of more than 500,000 barrels per day of bitumen, a heavy, tar-like oil. Athabasca is estimated to have total resources of 10 billion barrels in place.

The current expansion includes the construction of new mining, extraction and processing facilities at the Jackpine Mine.

The Scotford Upgrader, which processes the bitumen into lighter synthetic crude, is also being expanded. In all, expansion of the Athabasca Oil Sands Project will create 6,000 jobs during construction and 700 permanent jobs once operations begin.

We continue to invest in new technology to reduce costs and improve the efficiency of our oil sands operations. For example, Shell Enhance™ is an innovative new oil sands processing technology that will use smaller equipment, less water and less energy per barrel.

Summary Operating and Financial Review

Our strong cash generation and capital discipline continued to support our objectives of making significant investments to underpin long-term growth while increasing cash returned to shareholders.

Summary of Group results

GROUP RESULTS	
Earnings	$26,311 million
Hydrocarbon production	3,473 thousand boe per day
Capital investment	$24,896 million

2006 COMPARED TO 2005 AND 2004

The Group's businesses delivered strong operational and financial performance in 2006. Income for the Group in 2006 was $26.3 billion. The healthy financial position allowed the Group to return $16.3 billion to shareholders, while capital investment reached $24.9 billion.

The 2006 earnings were in line with 2005 which were up 36% from 2004. The increase in 2005 reflected higher realised oil and gas prices as well as higher LNG volumes and prices.

Exploration & Production earned $15.2 billion in 2006, up 7% from $14.2 billion in 2005. Earnings reflected higher oil prices, partly offset by lower production volumes, higher operating costs across the industry, increased pre-development activity for projects and lower gas prices in the USA. Production was 2% higher than 2005, excluding the impact of security concerns in Nigeria, the effect of higher prices on volumes shared with partners, and hurricanes in the Gulf of Mexico. This is an improvement over 2005 when volumes declined 1% versus 2004, when calculated on a similar basis.

Gas & Power earnings were up 68% reaching $2.7 billion in 2006, compared to $1.6 billion in 2005 and $1.8 billion in 2004. The increase in 2006 reflected growth in LNG sales volumes of 14% due to capacity added in Nigeria and Oman; our ability to direct LNG cargos to markets with higher prices; and strong marketing and trading performance in Europe and North America.

Oil Products earnings were $7.1 billion in 2006, 29% lower than 2005 and 6% lower than 2004. Lower refining earnings in 2006, compared to 2005, were partly offset by higher trading profits and increased Lubricants earnings. The impact of price volatility on inventory had favourable effects on 2006 earnings of around $0.1 billion, compared to around $2.5 billion in 2005.

Chemicals earnings were $1.1 billion compared to $991 million in 2005. Earnings in 2006 included $113 million of net charges, including legal and pension costs, compared to charges of $565 million in 2005, mainly from divestments. Excluding these effects, 2006 earnings were 24% lower than a year ago, reflecting lower margins, partly offset by higher earnings from minority interests and joint ventures, including the Nanhai petrochemicals complex in China. Earnings in 2005 were 14% lower than 2004.

BALANCE SHEET AND CAPITAL INVESTMENT

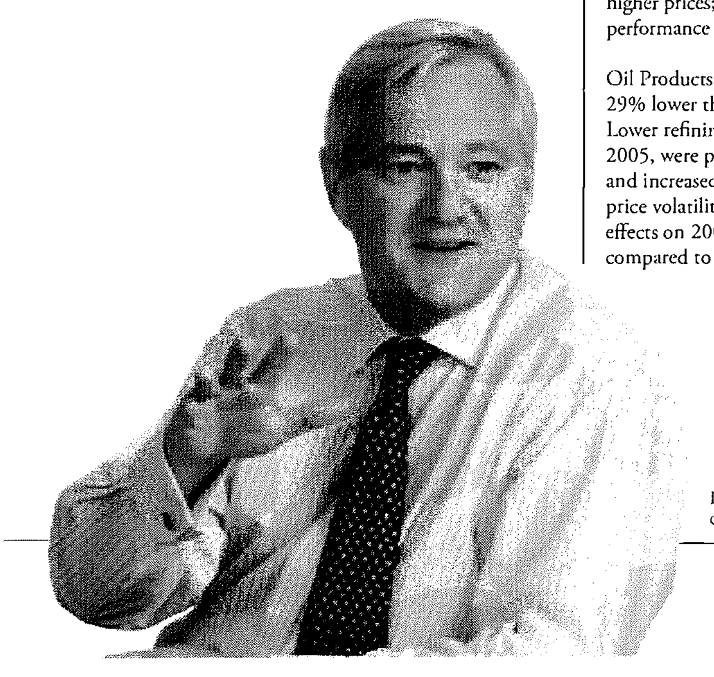
The most significant changes to the balance sheet in 2006 reflected the Group's strategy to invest in the development of long-term growth projects, primarily in the upstream businesses. Investment in property, plant and equipment increased by over $17 billion in 2006. Capital investment increased by over 40% in 2006, reaching $24.9 billion. This was partly offset by depreciation, depletion and amortisation of nearly $13 billion.

Over $20 billion of capital investment went to upstream projects that will deliver organic growth over the long term. These projects include several multi-billion-dollar, integrated facilities that should provide significant cash flow for the coming decades.

Capital investment in 2006 was primarily funded internally, either from cash from operations of $31.7 billion or with proceeds from divestments of $1.7 billion. Net debt increased by $5.6 billion to a year-end balance of $6.8 billion.

PORTFOLIO ACTIONS

In January 2007 the Group made an offer to the shareholders of Shell Canada Limited to acquire all of the outstanding common shares not owned by the Group at a cash price of C$45 per share. In December 2006 a protocol was signed to sell Gazprom a stake in Sakhalin II. Shell's interest will reduce to 27.5% when the protocol becomes effective.



Peter Voser
CHIEF FINANCIAL OFFICER

UPSTREAM

Exploration & Production

"In 2006 we delivered record earnings, again met our production targets, continued our exploration success and decided to proceed with new projects which will create major new legacy assets. Our focus is on delivery and long-term growth through technology, integration and scale."

EXPLORATION & PRODUCTION RESULTS

Segment earnings	$15,195 million
Hydrocarbon production	3,473 thousand boe per day
Capital investment	$17,944 million

EARNINGS AND INVESTMENT

Exploration & Production reported earnings of $15.2 billion in 2006, 7% higher than in 2005 and 55% higher than 2004. Earnings reflected higher oil prices, though these were partly offset by the impact of lower US gas prices, marginally lower production volumes, higher operating costs within the industry and increased appraisal activities in assessing potential projects.

Net gains of $641 million in 2006 – compared with $1.7 billion in 2005 and net charges of $4 million in 2004 – relate to changes in valuation of certain UK gas contracts and divestments gains. Investment totalled some $16.5 billion in 2006, a 53% increase on 2005 and 88% higher than 2004. Within this, exploration expenditure was $5.1 billion, of which $2.4 billion was related to acquisitions.

OUTLOOK AND STRATEGY

The exploration and production industry continued to experience higher oil prices, high activity levels, tightness in the supply of oilfield goods and services, cost escalation and strong competition for new opportunities. We anticipate that the environment in 2007 will be similar. We believe that crude oil prices in the near future will continue to be influenced by OPEC supply policy and the industry's limited ability to add significant near-term production capacity; the rate of global economic expansion, particularly in the USA, India and the Asia Pacific region; and, to a lesser extent, winter's severity in the northern hemisphere.

Exploration & Production continues to pursue the strategy in place for the last three years and delivery remains on track.

Our strategy has four portfolio themes: sustaining our established core countries, using our technology strengths to access and recover more oil and gas, integrated gas opportunities and unlocking unconventional resources. We will continue to pursue an aggressive exploration programme. We will also invest in organic growth, expanding and improving our portfolio by opening up new positions and making selective acquisitions, divestments and asset swaps. In our existing portfolio, we will focus on production and project delivery, cost performance and operational excellence.

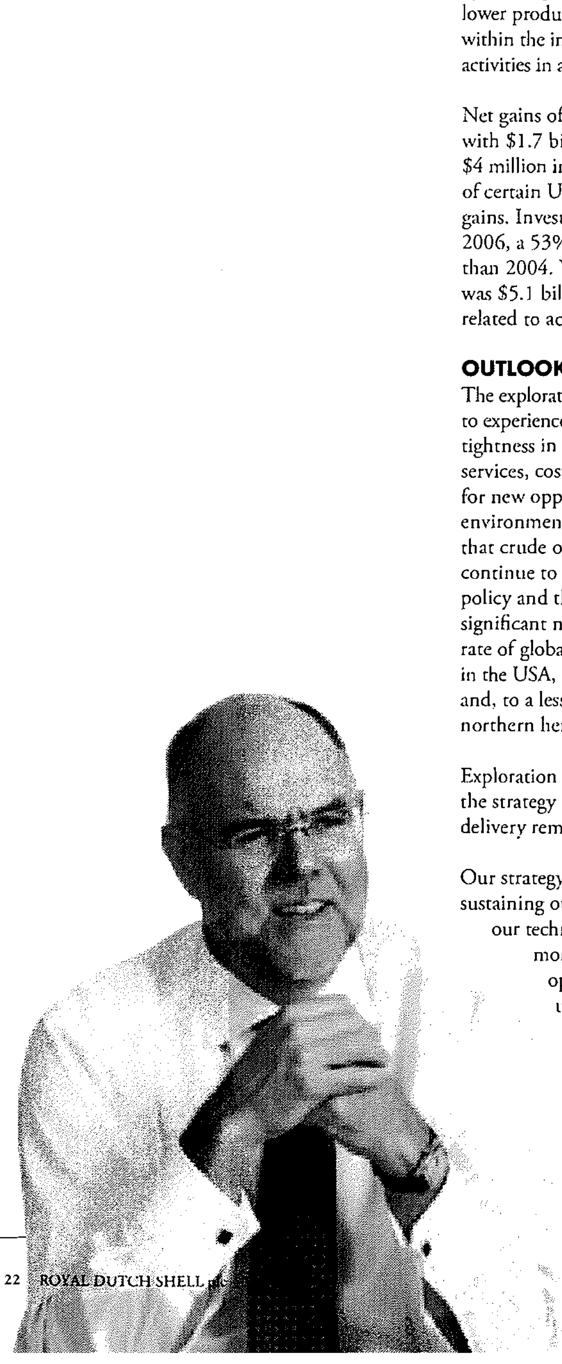
EXPLORATION AND PRODUCTION

In 2006 Shell participated in drilling 198 successful exploratory wells. We produced 3.5 million barrels of oil equivalent (boe) per day, 1% less than 2005 and 8% less than 2004. The underlying production trend, however, was up 2%, when excluding the impact of hurricanes, security concerns in Nigeria, and the effect of higher oil and gas prices on production volumes shared with partners. The effect of declining fields was more than offset by production from new fields in Nigeria, Malaysia, Brunei, and New Zealand. Production in the USA was boosted when the Mars platform in the Gulf of Mexico, heavily damaged by hurricane Katrina, resumed production at rates more than 20% higher than previously.

CAPITAL INVESTMENT AND PORTFOLIO ACTIONS

Our capital investment helped further rejuvenate our diverse portfolio. The Group made significant additions to its overall acreage position with new exploration licences in, among other countries, Australia, Canada, Denmark, Ireland, Norway, Philippines, Tunisia, Ukraine and the USA (onshore Alaska and the Gulf of Mexico). The additional exploration acreage amounted to 45 thousand square kilometres. We added some 2 billion boe to our proved oil and gas reserves and proven oil sands mining reserves.

Offshore we announced the go-ahead for development of the BC-10 deep water project in Brazil (Shell interest 50%). A central floating storage and offloading vessel with a capacity to process 100,000 boe per day will link the project's multiple wells on the sea-floor. In the USA, Shell and its partners announced the development of the Great White, Tobago and Silvertip fields in the Gulf of Mexico via the Perdido host facility, designed to handle 130,000 boe per day.



Malcolm Brinded
EXECUTIVE DIRECTOR, EXPLORATION & PRODUCTION

Gas & Power

In Nigeria, the first phase of the deep water Erha development (Shell interest 43.75%) started production in April. Offshore Brunei, crude oil production started from Phase III of the Champion West field (Shell interest 50%) using Smart Fields® technology. The additional production helped Brunei Shell Petroleum achieve a 25-year production record.

In Russia, Shell, Gazprom, Mitsui and Mitsubishi signed a protocol to bring Gazprom into the Sakhalin Energy Investment Company Ltd. (SEIC) as the leading shareholder. When the agreement is ratified Gazprom will acquire a 50% interest, plus one share, while the other partners will each dilute their interest by 50%. Shell will retain a 27.5% stake.

Acquisitions in Canada helped secure access to conventional and unconventional resources. The wholly owned Shell subsidiary SURE Northern Energy acquired more land in Northern Alberta to evaluate and potentially develop heavy oil. Shell Canada acquired BlackRock Ventures, which has conventional oil activities in the Athabasca region. And we received approval for the Athabasca Oil Sands Project Expansion 1 (Shell Canada interest 60%) that will enable a further 100,000 boe of production per day.

Important milestones allowed us to consolidate our strong position in the gas business. In Malaysia, the first gas was delivered from the offshore E8 field (Shell interest 50%). In New Zealand, the first gas was delivered from the Pohokura field (Shell interest 48%), which is expected to produce around 40,000 boe a day at its peak. In the USA, major long-term investments were approved to further develop the onshore gas projects at Pinedale in Wyoming and in South Texas.

In Norway, Shell and Statoil agreed to work towards developing the world's largest project using carbon dioxide (CO_2) for enhanced oil recovery offshore. If technical and economic challenges can be overcome, the plan would enable the capture of CO_2 from power generation and use it to enhance oil recovery, initially at the Shell-operated Draugen field and later at the Statoil-operated Heidrun field.

GAS & POWER RESULTS

Segment earnings	$2,650 million
LNG sales volume (tonnes)	12.1 million
Capital investment	$2,200 million

EARNINGS

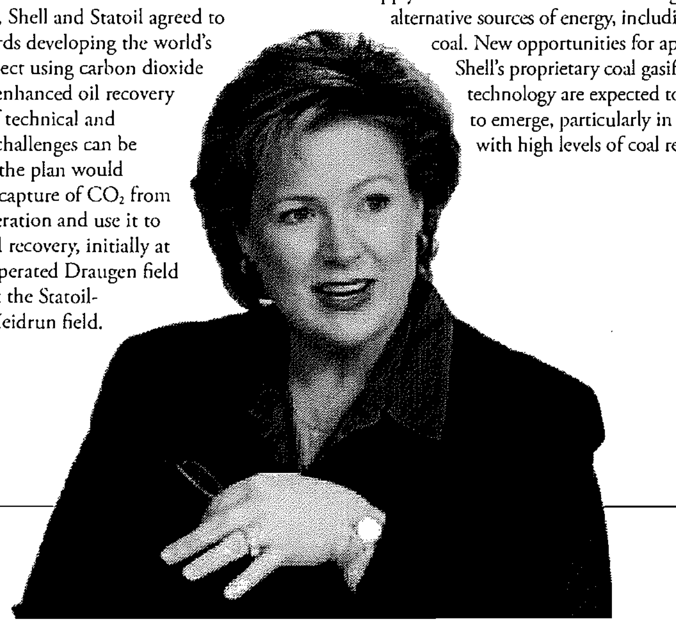
Gas & Power's earnings rose 68% to $2.7 billion in 2006 from $1.6 billion the year before and $1.8 billion in 2004. The rise in this year's results reflect 14% growth in LNG equity sales volumes and product prices reflecting high crude oil and natural gas prices. A strong marketing and trading performance in Europe and North America also contributed to results.

Earnings in 2005 included net charges of $84 million, mainly related to the divestment of the joint venture InterGen, whereas earnings in 2004 of $1.8 billion included net gains of $444 million related mainly to divestments.

OUTLOOK AND STRATEGY

The business environment for natural gas remains robust. We expect demand for natural gas to continue growing at around 2-3% per year over the medium term, reflecting moderate economic growth. Demand weakness, if it occurred, would likely be the result of a severe economic downturn. We expect LNG demand to continue to grow at around 10% per year for the next few years with growth in all major natural gas markets. We anticipate continued high levels of industry investment in engineering, design, construction, materials and services for major natural gas projects. Competition for access to natural gas resources and for commercially and technically skilled people will continue.

Concerns over security and diversity of energy supply will continue to drive increasing interest in alternative sources of energy, including clean coal. New opportunities for applying Shell's proprietary coal gasification technology are expected to continue to emerge, particularly in countries with high levels of coal reserves.



Our strategy is unchanged: build our position as one of the world's largest natural gas producers and suppliers of LNG, with a significant presence in the key markets of North America, Asia Pacific and Europe. We aim to access new natural gas resources by offering competitive propositions to our customers and major resource holders.

CAPITAL INVESTMENT AND PORTFOLIO ACTIONS

Total capital investment rose 37% to $2.2 billion in 2006 (including the minority interest share of capital investment in Sakhalin II of $400 million) compared to $1.6 billion in 2005 and $1.6 billion the year before. The capital investment increase from 2005 was mainly related to spending on the Qatar Pearl Gas to Liquids (GTL) project following the final investment decision in July 2006.

During the year, investments continued to focus on integrated gas projects involving LNG liquefaction plants at Sakhalin II, Qatargas 4, North West Shelf Train 5, Nigeria LNG Train 6, as well as the regasification terminal in Altamira, Mexico and the Qatar Pearl GTL project. We also completed the construction of our first coal gasification plant located in Dongting, China. There was no major divestment activity in 2006.

We made progress on a number of major LNG projects in 2006. The integrated Pearl GTL project was launched in July and several contracts were awarded to begin preparation of the site and construction.

The project includes the development of offshore natural gas resources from Qatar's North Field, transporting and processing the gas onshore to extract liquids, and the conversion of gas into clean liquid hydrocarbon products for export through the use of proprietary GTL technology. When fully on stream, the plant is expected to have a daily output of 140,000 barrels of GTL products, and an additional 120,000 barrels of oil equivalent per day of condensate, liquefied petroleum gas and ethane.

"In 2006, we delivered record earnings, cash flows and LNG volumes. We also achieved significant progress on the development of our major projects. We are on track to grow our position as one of the largest natural gas producers and suppliers of LNG."

Linda Cook
EXECUTIVE DIRECTOR, GAS & POWER

Also in Qatar, construction continued on the Qatargas 4 LNG Project (Shell interest 30%). This integrated project includes upstream gas and liquids production and an LNG liquefaction plant with a capacity of 7.8 million tonnes of LNG a year.

In Nigeria, construction continued on the Nigeria LNG (NLNG) liquefaction train 6 (Shell interest 26%) which will have a capacity of 4 million tonnes per year. NLNG is also making progress with development activities for a seventh (8.5 mtpa) LNG train. In February 2006, Shell signed a project development agreement with the Nigerian National Petroleum Corporation and other partners for the joint development of the new Olokola LNG project (Shell interest 18.5%).

In Australia, the North West Shelf venture (Shell direct and indirect interest 22%) delivered its first LNG cargo to China in May at the Guangdong LNG import terminal under a 25-year, 3.3 million tonnes-per-year agreement. Construction continued on the venture's LNG train 5 which, when completed, will increase overall plant capacity to 16.3 million tonnes a year.

The Greater Gorgon joint venture (Shell interest 25%) is considering development of an LNG liquefaction plant on Barrow Island off Western Australia that will be supplied with natural gas from the offshore Gorgon and Jansz/Io gas fields.

In Russia, further contracts were signed with customers for LNG from the Sakhalin II project (Shell interest 55%). Total firm sales now amount to 9.37 mtpa, representing some 98% of the plant's capacity. In 2006, a protocol was signed to sell Gazprom a stake in Sakhalin II. Shell's interest will reduce to 27.5% when the protocol becomes effective.

In Mexico, the Altamira regasification terminal (Shell ownership 50%, with 75% of the initial capacity of 4.4 million tonnes of LNG a year) was commissioned in August 2006 with the first-ever LNG cargo to be delivered to the country. The state power company in Mexico, Comisión Federal de Electricidad, has contracted to purchase 5.2 billion cubic metres of regasified LNG per year from the facility.

In the USA, permitting activities are progressing for the Broadwater LNG regasification terminal (Shell ownership 50%) in the Long Island Sound region of New York and Connecticut. Shell will hold 100% of the terminal's capacity of 7.7 million tonnes of LNG a year.

DOWNSTREAM

Oil Products

OIL PRODUCTS RESULTS	
Segment earnings	$7,125 million
Capital investment	$3,457 million

CHEMICALS RESULTS	
Segment earnings	$1,064 million
Capital investment	$877 million

"We achieved excellent financial performance in 2006 and our strategy is on track. We will continue to ensure that our operations are safe, reliable and cost competitive. We have made steady progress with our portfolio development as we strengthened our position in key markets. We will continue to leverage the Shell brand with strong customer focus and the development of leading-edge technologies."

EARNINGS

Oil Products earnings were $7.1 billion in 2006, 29% lower than 2005 and 6% lower than 2004. Lower refining earnings in 2006, compared to 2005, were partly offset by higher trading profits and increased Lubricants earnings. The impact of price volatility on inventory had favourable effects on 2006 earnings of around $0.1 billion, compared to around $2.5 billion in 2005.

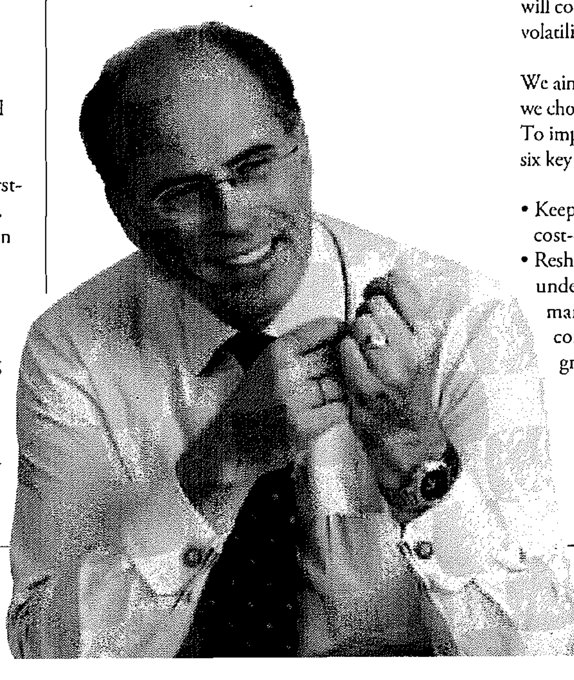
Earnings in 2006 included non-operational net gains of $38 million, compared to $427 million in 2005 and $540 million in 2004.

OUTLOOK AND STRATEGY

In 2006 refining margins remained well supported, with robust growth in product demand and supply constraints due to unusually intense industry turnaround activity following the hurricanes on the US Gulf Coast in 2005. In the absence of any major disruptions, refining margins are expected to trend lower in 2007 than 2006 with new conversion capacities coming on stream and the prospect for potentially slower economic growth. However, the eventual levels are uncertain and will be strongly influenced by the pace of global economic growth, the effect of persistently high oil prices on product demand and start-up timing of expected refinery expansion. Marketing margins will continue to be influenced by oil price volatility, exchange rates and intense competition.

We aim to lead in the downstream markets in which we choose to operate. Our strategy supports this. To improve downstream profitability we focus on six key areas:

- Keeping our operations safe, reliable and cost-competitive.
- Reshaping the portfolio by divesting underperforming assets, selectively investing in manufacturing and marketing to improve our competitive position and investing in high growth markets such as China and India.



Rob Routs
EXECUTIVE DIRECTOR, OIL PRODUCTS AND CHEMICALS

- Reinforcing our position as the leading global brand across all the downstream businesses, including through our focus on differentiated fuels.
- Continuing to implement simpler standard global processes for Oil Products businesses.
- Maximising the value of our integrated hydrocarbon supply chain and tighter integration of the Oil Products and Chemicals businesses.
- Continuous focus on human resources, development of leadership and progress in diversity.

CAPITAL INVESTMENT AND PORTFOLIO ACTIONS

Capital investment was $3.5 billion in 2006, up from $2.8 billion in 2005, and focused on our manufacturing and retail businesses. It included spending on refinery maintenance, fuel specification and environmental compliance, upgrading and growing our retail network, and two acquisitions in China. During the period 2004 – 2006 approximately 65% of our capital expenditure was allocated to asset integrity and care and maintenance projects.

We continued to focus on investment in high-growth markets, on consolidation in Africa and retrenchment in Latin America. In Turkey, we launched a joint venture retail network of 1,200 service stations with Turcas Petrol A.S (Shell interest 70%). And two acquisitions strengthened our market position in China. The purchase of a bitumen manufacturing and marketing business doubled our daily bitumen production in China to 6,600 tonnes, some 20% of our global production. We acquired 75% of China's leading independent lubricants manufacturer and marketer. This makes Shell the leading international lubricants company in China and increases our global finished lubricants volume by 8%.

Motiva Enterprises (Shell interest 50%), continued progress with plans to expand the Port Arthur refinery in the USA. The planned addition of 325,000 barrels a day would bring total capacity to more than 600,000 barrels a day. Construction on the project is likely to start in 2007, with the new capacity coming on line after 2010.

As part of our ongoing portfolio management we also sold a number of assets during 2006, including various businesses in a number of Pacific Islands, Puerto Rico, Bermuda, the USA, Colombia, Uruguay, Cambodia and Cameroon. We announced a strategic review of a number of refining and petrochemicals assets in France and the Dominican Republic.

Chemicals

EARNINGS

Earnings in 2006 were $1.1 billion for Chemicals, compared to $991 million in 2005, which included $307 million in losses from discontinued operations, and $1.1 billion in 2004, which included $199 million of net losses from discontinued operations. Setting aside the effect of discontinued operations, earnings for 2006 were $234 million lower than 2005. This was due to lower margins and higher depreciation partly offset by better earnings from minority interests and joint ventures, and lower taxes.

OUTLOOK AND STRATEGY

We expect demand for petrochemicals in 2007 to increase in line with growth in the global economy, but mainly in Asia Pacific. Industry capacity additions coupled with continued high feedstock and energy costs may limit the opportunities for improving margins.

The Chemicals strategy continues to focus on strengthening our existing asset base in the Americas and Europe and on achieving profitable growth in Asia Pacific and the Middle East. The emphasis will be on exploiting synergies between Oil Products and Chemicals, implementing global standards and processes, leveraging technology investment, and optimising global market positions.

CAPITAL INVESTMENT AND PORTFOLIO ACTIONS

In 2006, capital investment was $877 million, up from $599 million in 2005, driven by portfolio investments to build profitable growth in the Asia Pacific region, along with major programmes for plant maintenance and improvement.

Construction began on a new petrochemicals complex in Singapore using Shell's proprietary technology, which will be fully integrated with our Pulau Bukom refinery. Completion and start-up of the new facilities are expected around the end of the decade.

Excellent progress was made in the first year of operations at the Nanhai petrochemicals complex in China, a joint venture with the China National Offshore Oil Corp (Shell interest 50%). Completed on time and on budget, it is an operational and commercial success and provides an important presence in this expanding market. The complex began commercial production at the end of the first quarter and during 2006 sold 1.9 million tonnes of chemical products to more than 800 customers in over 20 provinces in China. When operating at full capacity Nanhai will produce 2.3 million tonnes of chemicals a year for the domestic Chinese market.

Other industry segments and Corporate

RESULTS	
Segment earnings	$277 million
Capital investment	$418 million

EARNINGS

Other industry segments (OIS) and Corporate earned $277 million in 2006, compared to a loss of $523 million in 2005, due to higher interest income, currency exchange results and improved corporate tax. Included in 2006 were net charges of $206 million related to a legal provision, partly offset by corporate tax credits. 2005 results included net charges of $151 million. While income from operating assets in OIS is improving, business development costs associated with growing the portfolio increased, contributing to an overall loss in 2006 in OIS.

CAPITAL INVESTMENT AND PORTFOLIO ACTIONS

During 2006, the Egmond aan Zee offshore wind park delivered its first clean electricity to households in the Netherlands. This is the first Dutch offshore wind project and has 36 turbines with an overall capacity of 108 megawatts (Shell interest 50%). We also made progress with the London Array wind project in the outer Thames Estuary. If approved, this project will have up to 271 turbines and could generate up to 1,000 megawatts of electricity (Shell interest 33%). We are one of the largest wind energy developers in the USA and we extended our presence there by making an investment decision on the 164-megawatt Mount Storm wind park in Virginia (Shell interest 50%). In solar, we have revised our approach to focus on advanced copper indium diselenide (CIS) thin-film technology. Shell has formed a joint venture with Saint-Gobain to develop a CIS thin-film technology plant in Germany. We also divested our crystalline silicon business to SolarWorld AG. Shell Hydrogen continued its work to promote the development of the infrastructure and technology that will help hydrogen play its part in meeting future energy needs. This included the announcement of Shell's participation in a project to create the world's largest hydrogen-fuelled public transport operation in the Netherlands. Shell CO_2 seeks to develop solutions to manage Shell's CO_2 emissions. In the Halten project we are working with Statoil to explore the potential of capturing CO_2 from power generation and injecting it into offshore oil fields to enhance oil recovery. We also announced a partnership with Stanwell Corporation to produce near zero-emission electricity from coal by applying Shell's coal gasification technology, together with underground storage of CO_2, to a power plant in Australia. Both of these projects are in the early feasibility study phase.

Key performance indicators

OVERALL PERFORMANCE – SCORECARD

The Group measures its performance through a number of key performance indicators that intend to evaluate the overall performance of the Group from a financial, efficiency, social and sustainable development perspective. In addition to a number of key performance indicators the Group monitors and manages the businesses by means of detailed parameters. The Group's future oil and gas production depends on the success of very large projects that require significant human and capital resources over longer periods of up to 10 to 30 years. The key performance indicators and parameters do not necessarily reflect the long-term performance of the Group although these might provide an impression of performance. The Group Scorecard highlights four key performance factors which together provide a summarised overview of the Group's performance. The four key performance indicators are measured on a quarterly basis. As explained on page 37, in the Summary Directors' Remuneration Report, the Scorecard is also used to determine remuneration for staff, Senior Management and Executive Directors.

TOTAL SHAREHOLDER RETURN (25% SCORECARD WEIGHTING)

Total Shareholder Return (TSR) is defined as the sum of the difference between the share price at the start of the year and the share price at the end of the year plus the cash value of dividends paid during the calendar year (gross and reinvested quarterly). The TSR is compared against other major integrated oil companies and provides therefore a benchmark of how the company is performing against its industry peers.

CASH FLOW FROM OPERATING ACTIVITIES (25% SCORECARD WEIGHTING)

Cash flow from operating activities is considered a measure that reflects the Group's ability to generate funding from operations for its investing and financing activities and is representative of the realisation of value for shareholders from the Group operations. The cash flow statement on page 42 shows the components of cash flow.

OPERATIONAL EFFICIENCY (30% SCORECARD WEIGHTING)

Within each of the different businesses, operational performance is measured by means of detailed parameters that are combined into a business dashboard. Operational excellence of Exploration & Production, Gas & Power, Oil Products and Chemicals is measured quarterly. The four key indicators for the businesses are production for Exploration & Production, LNG sales for Gas & Power, unplanned downtime for Oil Products and technical plant availability for Chemicals.

SUSTAINABLE DEVELOPMENT (20% SCORECARD WEIGHTING)

As well as measuring financial performance and efficiency, the Group uses various indicators to evaluate the Group's contribution to sustainable development. This Review discusses on pages 28 and 29 the Group's priorities with regards to staff and highlights key performance indicators such as greenhouse gas emissions, use of flaring and energy use in its businesses and assets. Safety remains a key topic in the Group and is measured by the number of injuries and fatal accidents, as discussed on page 29. It is the aim of the Group to work closely with customers, partners and policymakers to advance more efficient and sustainable use of energy and natural resources.

In addition to the four key performance indicators that determine the Group's Scorecard, additional financial indicators are used to evaluate the Group's performance.

GROUP SCORECARD	2006	2005
1 Total Shareholder Return	10.9%	19.2%
2 Cash flow from operations ($ billion)	31.7	30.1
3 Operational efficiency:		
– Oil and Gas production (thousand boe/day)	3,473	3,518
– LNG sales (million tonnes)	12.12	10.65
– Refining unplanned downtime	4.9%	4.0%
– Chemical plant availability	90.2%	82.2%
4 Sustainable development	2.3	2.5

Risk factors

Royal Dutch Shell has a single risk-based control framework – the Shell Control Framework – to identify and manage risks (see page 36).

The Group's operations and earnings are subject to various risks involving changing competitive, economic, political, legal, social, industry, business and financial conditions. These risks are more thoroughly discussed in our Annual Report and Form 20-F. Investors are urged to read our Form 20-F prior to making an investment decision. Investors should carefully consider these risks.

These risks could have a material adverse effect on the Group's results from operations and/or financial condition.

Fluctuating prices for oil, natural gas, oil products and chemicals.

Our ability to deliver large scale projects and replace oil and gas reserves.

Competition from within the energy industry and other industries.

Loss of business reputation due to real or perceived failure to follow the Shell General Business Principles.

The impact of climate change and any resulting challenges from society and governments.

Health, safety, security and environment risks.

Doing business in politically sensitive or unstable countries.

Inability to control or influence the operations, behaviours, and performance of our partners and ventures.

Information technology failures.

Lack of access to technology and inadequate innovation.

Challenge of resourcing skilled employees.

Changes in legislation, fiscal and regulatory policies and to expropriation of property.

Currency fluctuations and exchange controls.

Political or economical instability pose a risk to economic and financial market conditions.

Liquidity and capital resources

The estimation of reserves of oil and gas involves subjective judgements and determinations and may change based on new information. It is not an exact calculation.

Limitations on shareholder remedies. Provisions of our articles of association may affect the ability of shareholders to obtain monetary or other relief, including in respect of securities law claims.

Antitrust and competition law fines.

US Government sanctions regarding investments in Iran, Syria and Sudan.

Exposure to property and liability risks.

Trading and treasury risks, including movement in commodity prices, interest rates and foreign exchange rates.

The Group manages various pension plans that are subject to risks relating to changes in the value of investments, interest rates and demographic factors.

The most significant factors affecting year-to-year comparisons of cash flow provided by operating activities are changes in realised prices for crude oil and natural gas, crude oil and natural gas production levels, and refining and marketing margins. These factors are also the most significant affecting income. Acquisitions, divestments and other portfolio changes can affect the comparability of cash flows in the year of the transaction.

In the longer term, reserve replacement of conventional oil and gas and unconventional mining reserves will affect the ability of the Group to continue to maintain or increase production levels in Exploration & Production, which in turn will affect our cash flow provided by operating activities and income. We will need to take measures to maintain or increase production levels and cash flows in future periods, which may include developing new fields, continuing to develop and apply new technologies and recovery processes to existing fields, and making selective focused acquisitions. Our goal is to offset declines from production and increase reserve replacements. However, volume increases are subject to a variety of risks and other factors, including the uncertainties of exploration, project execution, operational interruptions, reservoir performance and regulatory changes.

It is our intention to continue to divest and, where appropriate, make selective focused acquisitions as part of active portfolio management. The number of divestments will depend on market opportunities and are recorded as assets held for sale where appropriate.

STATEMENT OF CASH FLOWS

Cash flow provided by operating activities reached a record level of $31.7 billion in 2006 compared with $30.1 billion in 2005 and $26.5 billion in 2004. Income in 2006 compared to 2005 remained the same at $26.3 billion up from $19.3 billion in 2004, reflecting continuing high realised prices in Exploration & Production and high refining margins in Oil Products.

FINANCIAL CONDITION AND LIQUIDITY

The Group's financial position is robust, and we returned over $16 billion to our shareholders through dividends and buybacks in 2006. Cash and cash equivalents amounted to $9.0 billion at the end of 2006 (2005: $11.7 billion). Total short and long-term debt rose $2.9 billion in the year. Total debt at the end of 2006 amounted to $15.8 billion.

CREDIT RATINGS

On June 12, 2006, Moody's Investors Services (Moody's) affirmed the Aa1 long-term issuer rating of Royal Dutch Shell plc, and of the guaranteed programmes and outstanding debt securities of its subsidiaries Shell International Finance B.V., Shell Finance (Netherlands) B.V. and Shell Finance (U.K.) P.L.C., and changed its outlook on the credit from negative to stable. Standard & Poor's Ratings Services (S&P) continues to rate the Group "AA" and to maintain a stable outlook on the credit. Short-term credit ratings of the commercial paper programmes remain unchanged at "Prime-1", and "A-1+" from Moody's and S&P respectively.

CAPITAL INVESTMENT AND DIVIDENDS

After servicing outstanding debt, the Group's first priority for applying our cash is the dividend. Up to and including the fourth-quarter 2006 interim dividend, the dividend was declared in euro, and per share increases in dividend were aligned with European inflation over time. On February 1, 2007 the Group announced that, effective from the first quarter 2007, dividends will be declared in US dollars and it expects that the first quarter 2007 interim dividend will be $0.36 per share, an increase of 14% over the US dollar dividend for the same period in 2006. The first quarter 2007 interim dividend will be declared on May 3, 2007.

Group companies' capital expenditure, exploration expense and new investments in equity accounted investments increased by $7.5 billion to $24.9 billion in 2006.

After dividends and capital investment, the priority for using cash generated is to maintain a strong and flexible balance sheet. Both the medium and long-term focus will remain on improving the underlying operational performance in order to continue to deliver consistently strong cash flows.

Share buyback plans will be reviewed periodically, and are subject to market conditions and the capital requirements of the company.

The Group manages its business to deliver strong cash flows to fund investment and growth based on cautious assumptions relating to crude oil prices. Our strong cash position in 2006, with operational cash flow of $31.7 billion, provided us the financial flexibility both to fund capital investment and to return cash to shareholders.

Our people

Shell employs 108,000 people in more than 130 countries. We made progress on all fronts in our global people strategy in 2006, in support of the Group strategy of more upstream and profitable downstream. Common policies and processes, delivered through an improved global information technology platform, helped improve and speed decision-making.

RESOURCING FOR THE FUTURE

In 2006 we recruited almost 6,000 people worldwide as a result of our strengthened global attraction and recruitment efforts. This comprised 1,500 graduates and 4,500 experienced professionals – over half of whom were from technical disciplines – from more than 60 countries.

A global technical marketing campaign generated a significant number of applicants from around the world, including more than 150 people via our employee referral programme. Women make up 27% of all our hires, and 28% of recruits for technical roles, and we continue to work towards improving these rates.

We have also been active in new recruitment markets, hiring more graduates and experienced professionals in Asia than in any other region in 2006. This directly supports increased future investment in the region. We are also building on our recruitment capability in the Middle East in support of regional Group activities, such as the Pearl GTL project with Qatar Petroleum. We have significantly stepped up recruitment in Nigeria and India, where just under 200 graduates and 75 experienced professionals were hired to support the establishment of Shell Technology India.

LEADING AND DEVELOPING OUR PEOPLE

Building skills, capabilities and organisational effectiveness remain key priorities for Shell. The Shell Project Academy is an integrated development programme for Shell employees working at all stages of the project life cycle. The programme includes learning events, assessment and accreditation, coaching and mentoring services, a global online knowledge network, project community events and work experience opportunities. Our Commercial Academy continued in 2006 to enhance business development skills by spreading knowledge and best practice across our major businesses.

We remain committed to the development of leadership through an integrated cross-business Shell leadership development programme, with around 10,000 leaders and employees with leadership potential taking part in 2006.

A co-ordinated, enterprise-wide approach to learning is being developed. This includes the online Shell Open University that now serves as a single, standardised learning resource to maintain and improve the professional skills of our people.

COMMUNICATION AND INVOLVEMENT

We encourage the involvement of our employees in the planning and direction of their work, and provide them with safe and confidential channels to report concerns.

In 2006 we conducted our biennial Shell People Survey to find out what our employees think about working for Shell. This year the survey was completed by 78% of employees, the same response rate as in 2004, with results generally positive. For example, results show that employees have a higher level of trust in leadership than that reflected by the last survey in 2004.

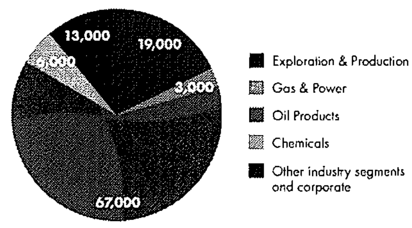
We are building on areas of strength that emerged from the survey, while developing action plans to address concerns raised.

DIVERSITY AND INCLUSIVENESS

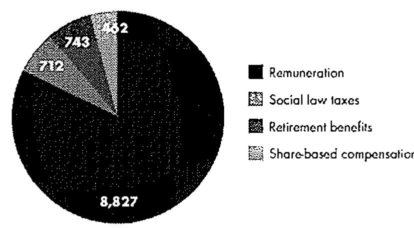
The Shell People Survey 2006 showed that 64% of employees perceived workplace inclusiveness favourably. The continuing integration of diversity and inclusiveness into the mainstream of Shell's operations and culture helps attract and retain the best people, increases creativity and improves decision-making. Three targets underpin our global efforts to embed diversity and inclusiveness in the way we run our business: increasing the proportion of women in senior leadership positions to at least 20% in the long term; having a majority of senior leadership positions filled by local nationals; and receiving increasingly more positive feedback of inclusiveness in the workplace, as measured in the Shell People Survey.

By the end of 2006, the proportion of women in senior leadership positions had risen to 11.6%, up from 9.9% in 2005. In 25% of countries, local nationals filled more than half the senior leadership positions.

2006 EMPLOYEES BY BUSINESS SEGMENT
Average numbers rounded to nearest thousand



2006 EMPLOYEE EMOLUMENTS **10,744**
In $ million



We seek to ensure equal opportunity in recruitment, career development, promotion, training and reward for all employees, including those with disabilities. All applicants and employees are assessed fairly and objectively.

While good progress has been made, we recognise we must continue to work towards achieving our targets in diversity and inclusiveness.

Environment and society

We recognise that our competitive success depends on finding environmentally and socially responsible ways to help meet the world's growing energy needs. This includes keeping the trust of a wide range of stakeholders. The Shell General Business Principles and our new Code of Conduct lay down the rules by which we work to do this, including our commitment to sustainable development. They require us, for example, to behave with integrity, operate our facilities safely, be a good neighbour, help development in the societies where we operate and help find effective ways to manage growing carbon dioxide (CO_2) emissions. They require us to comply with all applicable laws and to support human rights. Our commitment to sustainable development means combining economic, environmental and social considerations in our business decisions.

STANDARDS AND COMMITMENTS

We adhere to our principles, in part, by setting clear standards and requirements for our facilities and operations. They are required to live by our policy and commitment on health, safety and the environment (HSE), including our standards on animal testing, biodiversity, climate change, environmental and health management, incident reporting, security and ship quality. Companies and joint ventures where we have a control over operations must also apply these standards.

Decisions on all major new investments take into account the expected future costs of emitting CO_2. We carry out an impact assessment before starting significant work on a project or at an existing facility and incorporate our findings into the project's design and operation. All our major refining and chemicals facilities, as well as upstream operations where social impact could be high, must have social performance plans. These plans guide and monitor progress in managing our impact on our neighbours and on contributing positively to local communities.

CLIMATE CHANGE

Concern over greenhouse gas emissions (GHG) linked to climate change reached a new peak in 2006. We were one of the first energy companies to acknowledge the threat of climate change, to call for action, and to take action ourselves. In 1998, we set voluntary targets for reducing GHG emissions from our operations. In 2002, we met our first target – reducing emissions by 10% below 1990 levels – and we continue to work towards our current target of being 5% below 1990 levels by 2010, whilst growing our business. Meeting this target depends mainly on ending continuous flaring of natural gas and improving the energy efficiency of our facilities.

In 2006, reduced flaring led to Shell-operated facilities emitting about 7 million tonnes fewer GHG emissions than the previous year, and more than 20% below 1990 levels. Shut-in production in Nigeria was the biggest contributor, however reductions also came from increased recovery of gas from operations and reduced flaring in Gabon.

In 2006 we missed our energy efficiency target at our refineries, partly because producing environmentally friendly low-sulphur fuels takes more energy and partly because of unplanned, energy-intensive shutdowns. Our chemicals plants met their energy efficiency targets, despite several shutdowns.

Over the last five years we have invested more than $1 billion in alternative energy such as wind, solar, biofuels and hydrogen. We have increased the supply of natural gas, which has half the carbon emissions of coal, and are refining more low-sulphur transport fuels. We are a strong supporter of emissions trading systems to encourage companies to reduce their environmental impact, and are one of the most active traders in the European Union Emissions Trading Scheme. We have launched public campaigns to encourage innovation and promote energy conservation such as the Shell Eco-marathon, FuelStretch, and Shell Fuel Economy World Record Challenge.

We are involved in several major projects to drive down costs and demonstrate the safety of capturing CO_2 emitted from fossil fuel combustion and storing it underground.

OPERATING SAFELY AND SECURELY

Safety and security are of paramount importance to Shell. We are investing to keep our facilities safe and prevent incidents such as spills, fires and accidents. Total spill volumes in 2006 were slightly higher than the previous year due to two big spills in Nigeria that were responsible for a quarter of the total. Outside Nigeria the volume of preventable spills – from corrosion or operational failures – continued to drop.

We are working to improve our safety performance. We created a dedicated global safety function that will improve compliance with standards and procedures worldwide. In 2006 the injury rate among employees and contractors continued to fall. Sadly, however, two employees and 35 contractors lost their lives, one more than in 2005. Of these, 17 deaths occurred in Nigeria – nine from kidnappings and assaults. To improve security, we continued to work with a global network of government agencies, commercial security providers and industry peers.

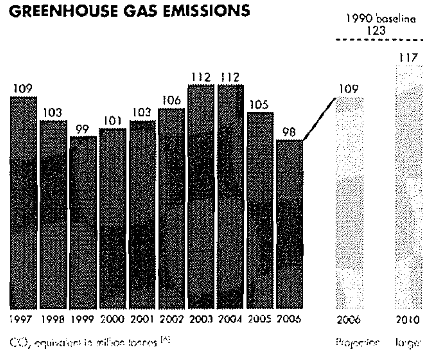
BIODIVERSITY

Exploration for oil and gas in ever-more remote regions increases the need to protect biodiversity. We work with more than 100 scientific and conservation organisations to achieve this. We were the first energy company to adopt a Biodiversity Standard, which ensures that as part of the impact assessment of any project we work with experts and stakeholders to develop ways of managing potential effects on biodiversity. We have committed to not exploring or drilling for oil or gas in natural World Heritage sites and to following strict operating practices, including implementing action plans in all areas of high biodiversity.

BEING A GOOD NEIGHBOUR

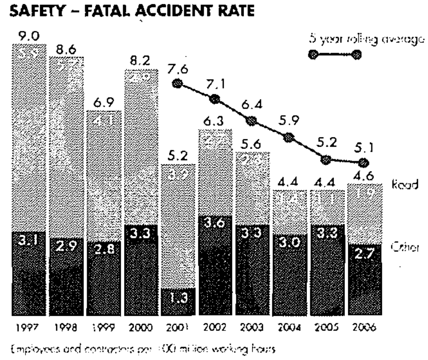
A vital part of our commitment to sustainable development is our continuous effort to build and maintain good relations with communities close to our operations. We aim to run our facilities safely and cleanly and we work with local people to help them benefit from our activities. We run social investment programmes and we encourage governments to spend the taxes and royalties we pay them to support development and reduce poverty.

GREENHOUSE GAS EMISSIONS



[A] Petroleum Industry Guidelines for Greenhouse Gas Estimation, December 2003, (API, IPIECA, OGP) indicate that uncertainty in greenhouse gas measurements can be significant depending on the methods used.

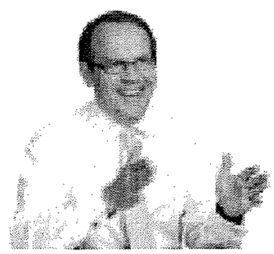
SAFETY – FATAL ACCIDENT RATE



The Board of Royal Dutch Shell plc

Royal Dutch Shell has a single tier Board of Directors chaired by Jorma Ollila. The executive management is led by the Chief Executive, Jeroen van der Veer. The members of the Board of Royal Dutch Shell meet regularly to discuss performance and plans of the business of Royal Dutch Shell.

On March 7, 2007 the Nomination and Succession Committee recommended the appointment of Rijkman Groenink as a Director of the Company to succeed Aarnout Loudon, who will retire from the Board at the conclusion of the 2007 Annual General Meeting. The Board adopted this recommendation and a resolution will be submitted to the 2007 Annual General Meeting proposing the election of Mr Groenink as a Director of the Company with effect from May 16, 2007. Mr Groenink's biographical details are given in the 2007 Notice of Meeting.



Jorma Ollila

N

Chairman

Born August 15, 1950. A Finnish national, appointed Chairman of Royal Dutch Shell as from June 1, 2006. Previously he was Vice-President of International Operations of Nokia in 1985. In 1986 he was appointed Vice-President Finance of Nokia and served between 1990 and 1992 as President of Nokia Mobile Phones. Between 1992 and 1999 he was President and Chief Executive Officer of Nokia and from 1999 to June 1, 2006 he has been Chief Executive Officer of Nokia. Prior to joining Nokia, he started his career in banking at Citibank in London and Helsinki. Currently he is Chairman of the Board of Nokia and a Non-executive Director of Ford Motor Company.

Lord Kerr of Kinlochard GCMG

N

Deputy Chairman and Senior Independent Non-executive Director

Born February 22, 1942. A British national, appointed a Non-executive Director of Royal Dutch Shell in October 2004. He was a Non-executive Director of Shell Transport from 2002 to 2005. A member of the UK Diplomatic Service from 1966 to 2002, he was UK Permanent Representative to the EU, British Ambassador to the USA, Foreign Office Permanent Under Secretary of State, and Secretary-General of the European Convention. He is a Non-executive Director of Rio Tinto plc and Rio Tinto Limited and the Scottish American Investment Company plc, Chairman of Imperial College, and Trustee of the National Gallery and of the Rhodes, Fulbright, and Carnegie Trusts.

Jeroen van der Veer

Chief Executive

Born October 27, 1947. A Dutch national, appointed Chief Executive of Royal Dutch Shell in October 2004. He was appointed President of Royal Dutch in 2000, having been a Managing Director of Royal Dutch since 1997 and was a Board member of Royal Dutch until the merger of the company on December 21, 2005. He was a Director of Shell Canada Limited from April 24, 2003 until April 29, 2005. He joined the Group in 1971 in refinery process design and held a number of senior management positions around the world. He is a Non-executive Director of Unilever (which includes Unilever N.V., Unilever plc and Unilever Holdings Ltd.).

Nina Henderson

A S

Non-executive Director

Born July 6, 1950. A US national, appointed a Non-executive Director of Royal Dutch Shell in October 2004. She was a Non-executive Director of Shell Transport from 2001 to 2005. Previously President of a major division and Corporate Vice-President of Bestfoods, a major US foods company, responsible for worldwide core business development. Non-executive Director of Pactiv Corporation, AXA Financial Inc., Del Monte Foods Company and Visiting Nurse Service of New York.

Sir Peter Job KBE

Non-executive Director

Born July 13, 1941. A British national, appointed a Non-executive Director of Royal Dutch Shell in October 2004. He was a Non-executive Director of Shell Transport from 2001 to 2005. Previously he was Chief Executive of Reuters Group plc. He is a Non-executive Director of Schroders plc and TIBCO Software Inc. and a member of the supervisory board of Deutsche Bank AG.

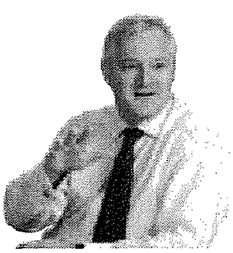
Wim Kok

S

Non-executive Director

Born September 29, 1938. A Dutch national, appointed a Non-executive Director of Royal Dutch Shell in October 2004. He was a member of the Royal Dutch supervisory board from 2003 to July 4, 2005. Chaired the Confederation of Dutch trade unions (FNV) before becoming a member of the Lower House of Parliament and parliamentary leader of the Partij van de Arbeid (Labour Party). Appointed Minister of Finance in 1989 and Prime Minister in 1994, serving for two periods of government up to July 2002. Member of the supervisory boards of Stork N.V., ING Groep N.V., KLM N.V. and TNT N.V.

A Audit Committee
Remuneration Committee
S Social Responsibility Committee
N Nomination and Succession Committee



Peter Voser

Chief Financial Officer

Born August 29, 1958. A Swiss national, appointed Chief Financial Officer of Royal Dutch Shell in October 2004. He was appointed a Managing Director of Shell Transport and Chief Financial Officer (CFO) in October 2004. In 2002 he joined the Asea Brown Boveri (ABB) Group of Companies, based in Switzerland as CFO and Member of the ABB Group Executive Committee. Also responsible for ABB's Group IT and the Oil, Gas and Petrochemicals business. Originally joined the Shell Group in 1982 where he held a variety of finance and business roles in Switzerland, UK, Argentina and Chile, including CFO of Oil Products. He was a member of the supervisory board of Aegon N.V from 2004 until April 25, 2006. He is a member of the supervisory board of UBS AG and a member of the Swiss Federal Auditor Oversight Authority.

Malcolm Brinded CBE FREng

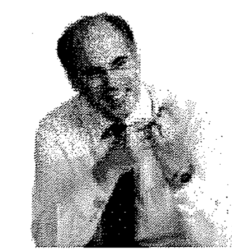
Executive Director, Exploration & Production

Born March 18, 1953. A British national, appointed an Executive Director of Royal Dutch Shell in October 2004. He was previously a Managing Director of Shell Transport since March 2004 and prior to that a Managing Director of Royal Dutch since 2002. Joined the Group in 1974 and has held various positions around the world including Country Chair for Shell in the UK, and Director of Planning, Environment and External Affairs at Shell International Ltd.

Linda Cook

Executive Director, Gas & Power

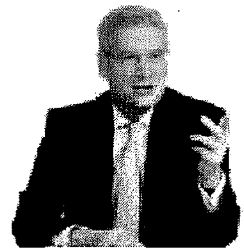
Born June 4, 1958. A US national, appointed an Executive Director of Royal Dutch Shell in October 2004. She was appointed a Managing Director of Royal Dutch in August 2004 and was a Board member of Royal Dutch until the merger of the company on December 21, 2005. She was President and Chief Executive Officer and a member of the Board of Directors of Shell Canada Limited from August 2003 to July 2004. Joined Shell Oil Company in Houston in 1980, and worked for Shell Oil Company in Houston and California in a variety of technical and managerial positions. Member of the Society of Petroleum Engineers and a Non-executive director of The Boeing Company



Rob Routs

Executive Director, Oil Products and Chemicals

Born September 10, 1946. A Dutch national, appointed Executive Director of Royal Dutch Shell in October 2004. He was a Managing Director of Royal Dutch from 2003 to July 4, 2005. Joined the Group in 1971. Held various positions in the Netherlands, Canada and the USA. Previously President and Chief Executive Officer of Shell Oil Products USA, President of Shell Oil Company and Country Chair for Shell in the USA and Chief Executive of Equilon. He is a member of the Board of Directors of Shell Canada Limited since April 29, 2005 and a director of INSEAD.



Maarten van den Bergh

S

Non-executive Director

Born April 19, 1942. A Dutch national, appointed Non-executive Director of Royal Dutch Shell in October 2004. He was a member of the Royal Dutch supervisory board from 2000 to July 4, 2005. Managing Director of Royal Dutch from 1992 to 2000 and President from 1998 to 2000. He was Chairman of the Board of Directors of Lloyds TSB from 2001 to May 11, 2006. He is a member of the Boards of Directors of BT Group plc and British Airways plc and Chairman of the supervisory board of Akzo Nobel N.V.

Nick Land

A

Non-executive Director

Born February 6, 1948. A British national, appointed a Non-executive Director of Royal Dutch Shell as from July 1, 2006. He qualified as an accountant in 1970 and was a partner of Ernst & Young LLP from 1978 until June 30, 2006. He was Chairman of Ernst & Young LLP and a member of the Global Executive Board of Ernst & Young Global LLP from 1995 until June 30, 2006. He is a Non-executive Director of BBA Aviation plc, Ashmore Group plc and Vodafone Group plc, Chairman of the Practice Advisory Board of the Institute of Chartered Accountants of England and Wales, and a member of the Advisory Board of the Judge Business School, and the Finance and Audit Committees of the National Gallery.

Jonkheer Aarnout Loudon

N

Non-executive Director

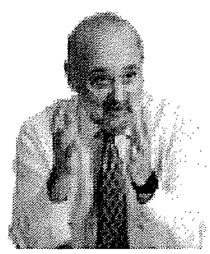
Born December 10, 1936. A Dutch national, appointed a Non-executive Director of Royal Dutch Shell in October 2004. He was a member of the Royal Dutch supervisory board from 1997 and was a Board member of Royal Dutch until the merger of the company on December 21, 2005. He was a member of the Board of Management of Akzo from 1977 to 1994 (Akzo Nobel as from 1994) and its Chairman from 1982 to 1994. He is former Chairman of the supervisory boards of ABN Amro Holding N.V. and Akzo Nobel N.V., a member of the International Advisory Board of Allianz AG, a member of the European Advisory Board of Lehman Brothers Europe Ltd and adviser to Cinven Ltd.

Christine Morin-Postel

A

Non-executive Director

Born October 6, 1946. A French national, appointed a Non-executive Director of Royal Dutch Shell in October 2004. She was a member of the Royal Dutch supervisory board from July 2004 and was a Board member of Royal Dutch until the merger of the company on December 21, 2005. Formerly she was Chief Executive of Société Générale de Belgique, Executive Vice-President and member of the Executive Committee of Suez S.A. Chairman and CEO of Credisuez plc from 1996 to 1998 and a Non-executive director of Pilkington plc. She is Non-executive director of Alcan Inc. and 3i Group plc.



Lawrence Ricciardi

A

Non-executive Director

Born August 14, 1940. A US national, appointed a Non-executive Director of Royal Dutch Shell in October 2004. He was appointed a member of the Royal Dutch supervisory board in 2001 and was a Board member of Royal Dutch until the merger of the company on December 21, 2005. Previously he was President of RJR Nabisco, Inc. and subsequently Senior Vice-President and General Counsel of IBM. He is Senior Advisor to the IBM corporation as well as to Jones Day and to Lazard Frères & Co, a member of the Board of Directors of The Reader's Digest Association, Inc. and Trustee of the Andrew W. Mellon Foundation and the Pierpoint Morgan Library.

Michiel Brandjes

Company Secretary

Born December 14, 1954. A Dutch national, appointed as Company Secretary of Royal Dutch Shell in February 2005. Previously Company Secretary of Royal Dutch and Group general counsel corporate. Joined the Group in 1980 as a Legal Adviser.

Summary Report of the Directors

PRINCIPAL ACTIVITIES
Royal Dutch Shell is a holding company which owns, directly or indirectly, investments in the numerous companies constituting the Group. The Group is engaged worldwide in the principal aspects of the oil and natural gas industry. The Group also has interests in chemicals as well as interests in power generation and renewable energy.

BUSINESS REVIEW
Throughout this report the Board aims to present a balanced and understandable assessment of Royal Dutch Shell's position and prospects in its financial reporting to shareholders and other interested parties. Our corporate website, www.shell.com/investor has information for institutional and retail shareholders alike. Shareholders seeking information may contact the Company directly throughout the year. They also have an opportunity to ask questions in person at the Annual General Meeting (AGM).

RECENT DEVELOPMENTS AND POST BALANCE SHEET EVENTS
Since December 31, 2006 additional purchases of shares have been made under the buyback programme. As at February 27, 2007 an additional 14,220,000 Class A shares (representing 0.2% of Royal Dutch Shell's entire issued share capital at December 31, 2006) had been purchased for cancellation at a total cost of $486 million including expenses, at an average price of $34.18 per Class A share. For disclosure on recent developments please refer to Portfolio Actions on page 21.

FINANCIAL STATEMENTS AND DIVIDENDS
The Summary Consolidated Statement of Income and Summary Consolidated Balance Sheet are available on pages 40 and 41.

BOARD OF DIRECTORS
The Directors during the year were Maarten van den Bergh, Malcolm Brinded, Sir Peter Burt (retired May 16, 2006), Linda Cook, Nina Henderson, Aad Jacobs (retired May 31, 2006), Sir Peter Job, Lord Kerr of Kinlochard, Wim Kok, Nick Land (appointed with effect from July 1, 2006), Aarnout Loudon, Christine Morin-Postel, Jorma Ollila (appointed with effect from June 1, 2006), Lawrence Ricciardi, Rob Routs, Jeroen van der Veer and Peter Voser. There have been no changes to this membership between the year end and the date of this Annual Review.

ELECTION AND RE-ELECTION OF DIRECTORS
The Directors seeking re-election at the 2007 AGM are Malcolm Brinded, Linda Cook, Maarten van den Bergh, Nina Henderson and Christine Morin-Postel. Aarnout Loudon is retiring and not seeking re-election at the 2007 AGM.

Shareholders will also be asked to vote on the election of Rijkman Groenink as a Director of the Company.

The biographies of all Directors can be found on pages 30 and 31 and, for those seeking election or re-election, also in the Notice of the Annual General Meeting. Details of the Executive Directors' service contracts can be found on page 38 and copies are available for inspection from the Company Secretary.

The terms and conditions of appointment of Non-executive Directors are set out in their letters of appointment with Royal Dutch Shell which, in accordance with the Combined Code, are available for inspection from the Company Secretary.

No Director is, or was, materially interested in any contract subsisting during or at the end of the year that was significant in relation to Royal Dutch Shell's business.

QUALIFYING THIRD PARTY INDEMNITIES
Royal Dutch Shell has entered into a deed of indemnity with each of the Directors. The terms of these deeds are identical and reflect the statutory provisions on indemnities introduced by the Companies (Audit, Investigations and Community Enterprise) Act 2004. Under the terms of each of these deeds, Royal Dutch Shell has indemnified each of the Directors, to the widest extent permitted by the applicable laws of England and Wales, against any and all liability, howsoever caused (including by that Director's own negligence), suffered or incurred by that Director in the course of that Director acting as a Director or employee of Royal Dutch Shell, any Group member and/or certain other entities.

SHARE CAPITAL
The Company's authorised and issued share capital as at December 31, 2006 is set out in Note 11 to the Parent Company Financial Statements in the Annual Report and Form 20-F for the year ended December 31, 2006.

SHARE PURCHASES
On May 16, 2006 shareholders approved an authority, expiring at the end of the next AGM, for Royal Dutch Shell to purchase its own shares up to a maximum of 5% of the issued share capital (excluding share purchases for employee share benefit plans). During 2006, 244,672,974 Class A shares with a nominal value of €17.1 million (representing 3.8% of Royal Dutch Shell's entire issued share capital at December 31, 2006) had been purchased for cancellation for a total cost of $8,200 million, including expenses, at an average price of $33.51 per Class A share. Since the year end additional purcbases have been made (see "Recent developments and post balance sheet events").

The Board continues to regard the ability to repurchase issued shares in suitable circumstances as an important part of the financial management of Royal Dutch Shell. A resolution will be proposed to the forthcoming AGM to renew the authority for Royal Dutch Shell to purchase its own share capital up to specified limits for another year. More detail of this proposal is given in the Notice of the AGM.

DIRECTORS' INTERESTS

The interests (in shares or calculated equivalents) of the Directors in office at the end of the financial year, including any interests of a spouse or infant child, are set out below:

	January 1, 2006[A]		December 31, 2006[B]	
	Class A	Class B	Class A	Class B
Maarten van den Bergh	8,000	–	8,000	–
Malcolm Brinded	–	22,397	14,432	22,885
Linda Cook	27,484[C]	–	27,484[C]	–
Nina Henderson	–	2,585[D]	–	4,584[E]
Sir Peter Job	–	1,056	–	1,492
Lord Kerr of Kinlochard	–	2,873	–	4,000
Wim Kok	500	–	500	–
Nick Land	–	3,074[F]	–	3,074
Aarnout Loudon	150,000	–	150,000	–
Christine Morin-Postel	1,960	–	1,960	–
Jorma Ollila	4,000[G]	–	4,000	–
Lawrence Ricciardi	20,000[H]	–	20,000[H]	–
Rob Routs	1,000	–	1,023	–
Jeroen van der Veer	26,836	–	46,175	–
Peter Voser	2,000	–	2,000	–

[A] Excludes interests in shares or options awarded under the Long-Term Incentive Plan, the Deferred Bonus Plan and the Share option plans as at January 1, 2006.
[B] Excludes interests in shares or options awarded under the Long-Term Incentive Plan, the Deferred Bonus Plan and the Share option plans as at December 31, 2006
[C] Held as 13,742 ADRs (RDS.A ADR). One RDS.A ADR represents two RDS A ordinary shares.
[D] Held as 1,292 ADRs (RDS.B ADR). One RDS.B ADR represents two RDS B ordinary shares.
[E] Held as 2,292 ADRs (RDS.B ADR). One RDS.B ADR represents two RDS B ordinary shares
[F] On date of appointment July 1, 2006.
[G] On date of appointment June 1, 2006.
[H] Held as 10,000 ADRs (RDS A.ADR). One RDS.A ADR represents two RDS A ordinary shares

There were no changes in Directors' share interests during the period from December 31, 2006 to March 7, 2007 except that Christine Morin-Postel purchased 3,800 Royal Dutch Shell Class A shares on February 2, 2007, Wim Kok purchased 1,250 Royal Dutch Shell Class A shares on February 9, 2007, Jorma Ollila purchased 10,000 Royal Dutch Shell Class A shares on February 14, 2007 and Jeroen van der Veer purchased 3,825 Royal Dutch Shell Class A shares on February 14, 2007.

SUBSTANTIAL SHAREHOLDINGS

As at February 27, 2007 Royal Dutch Shell had been notified by the following investors of their interests in 3% or more of the Company's shares. These interests are notified to the Company pursuant to Disclosure and Transparency Rule 5.

Investor	Class A shares	Class B shares
Barclays PLC	6.45%	5.43%
Legal and General Group Plc	3.49%	3.96%
The Capital Group Companies Inc	7.24%	4.58%

AUDITORS

PricewaterhouseCoopers LLP have signified their willingness to continue in office, and a resolution for their reappointment will be submitted to the AGM.

ANNUAL GENERAL MEETING

The AGM will take place on May 15, 2007 and will be held in the Circustheater, Circusstraat 4, The Hague, the Netherlands with a satellite link to the Novotel London-West Hotel and Convention Centre, Hammersmith, London, UK. An audio-visual link will permit active two-way participation by persons physically present in the UK and the Netherlands.

Details of the business to be put to shareholders at the AGM can be found in the Notice of the Annual General Meeting.

By Order of the Board

Michiel Brandjes
Company Secretary
March 7, 2007

Summary corporate governance

CORPORATE GOVERNANCE

Royal Dutch Shell is committed to the highest standards of corporate governance. We believe that such standards are essential to business integrity and performance. This report sets out the policies and practices of the Company that have been applied during the year.

The Board confirms that during the year the Company complied with the principles and provisions set out in Section 1 of the Combined Code.

In addition to complying with the corporate governance requirements in the UK, the Company must follow the rules of the Euronext Stock Exchange as well as Dutch securities laws due to its listing on this exchange. It must also follow US securities laws and the New York Stock Exchange (NYSE) rules and regulations due to registration of its securities in the US and the listing of its securities on the NYSE.

The NYSE corporate governance rules allow foreign private issuers to follow home country practice. However, foreign private issuers are required to have an audit committee that satisfies the requirements of US Securities and Exchange Act Rule 10A-3. The NYSE also requires a foreign private issuer to provide certain written affirmations and notices to the NYSE as well as a summary of the ways in which their corporate governance practices significantly differ from those followed by domestic US companies under NYSE listing standards. Our summary is available at: www.shell.com/investor.

SHELL GENERAL BUSINESS PRINCIPLES

The Shell General Business Principles define how Shell companies are expected to conduct their affairs. These principles were revised and strengthened in August 2005 with the aim to ensure that employees both understand them and confirm that they act in line with them. They include, among other things, the commitment of the Group to support fundamental human rights and to contribute to sustainable development and can be found on www.shell.com/sgbp.

SHELL CODE OF CONDUCT

During the year, the Board approved a Shell Code of Conduct which intended to help individual employees put our Business Principles into practice through the basic rules and standards we expect them to follow and the behaviour we expect of them. The Shell Code of Conduct, available on www.shell.com/codeofconduct, was distributed to all staff in December 2006. In 2007, steps will be taken to ensure that staff understand the Code, the responsibility they have to abide by it, and how it relates to their daily work.

CODE OF ETHICS

Executive Directors and Senior Financial Officers of the Shell Group must also comply with a Code of Ethics. This Code is specifically intended to meet the requirements of Section 406 of the Sarbanes Oxley Act and the listing requirements of the NYSE. The Code of Ethics can be found on the website www.shell.com/codeofethics.

WHISTLE-BLOWING

An internal global Group-wide procedure for employees to raise ethics and compliance concerns has replaced a number of national whistle-blowing procedures which were in operation. The Shell Global Helpline was introduced at the end of 2005 and was rolled out country by country. This worldwide reporting mechanism, operated by a third party, is open 24 hours a day, seven days a week through local telephone numbers and through the internet at www.shell.com or www.compliance-helpline.com/shell. In addition, an internal global procedure for employees to raise in confidence accounting, controls and auditing concerns was in place throughout the year.

BOARD STRUCTURE AND COMPOSITION

During 2006, the Board comprised the Chairman, Jorma Ollila (appointed with effect from June 1, 2006 and endorsed by shareholders at the 2006 AGM), five Executive Directors, including the Chief Executive, Jeroen van der Veer, and nine Non-executive Directors, including the Senior Independent Non-executive Director, Lord Kerr of Kinlochard, who is also the Deputy Chairman. A list of Directors, with their biographies, is on pages 30 and 31 of this Review.

ROLE OF DIRECTORS

The roles of the Chairman, a non-executive role, and the Chief Executive are separate and the Board has agreed their respective responsibilities. The Chairman, Jorma Ollila, is responsible for the leadership and management of the Board and for ensuring that the Board and its committees function effectively. The Chief Executive, Jeroen van der Veer, bears overall responsibility for the implementation of the strategy agreed by the Board, the operational management of Royal Dutch Shell and the business enterprise connected with it. He is supported in this by the Executive Committee, which he chairs.

NON-EXECUTIVE DIRECTORS

The Non-executive Directors bring a wide range of skills and international business experience to the Group. They also bring independent judgement on issues of strategy, performance and risk through their contribution to Board meetings and to the Board's committee meetings. They meet routinely without the Executive Directors to discuss, among other things, the performance of individual Directors.

All the Non-executive Directors as at the end of 2006 are considered by the Board to be wholly independent of any personal business connection with the Company or companies of the Group, with the exception of Maarten van den Bergh who receives a pension from a Shell Group pension fund. The standard by which Directors' independence is determined can be found on the website at www.shell.com/investor within the Terms of Reference of the Nomination and Succession Committee.

SIGNIFICANT COMMITMENTS OF THE CHAIRMAN

The other significant commitments of the Chairman are given in his biography on page 30.

BOARD ACTIVITIES DURING THE YEAR

The Board met eight times during the year, and all but one meeting were held in The Hague, the Netherlands. The agenda for each meeting comprises a number of regular items, including reports from each of the Board Committees, a report from each of the Chief Executive and the Chief Financial Officer and business reports from each of the other Executive Directors.
At most meetings the Board also considered a number of investment proposals. In accordance with the matters specifically reserved for the Board, during the year the Board considered numerous strategic issues and approved each of the quarterly financial results and dividend announcements.
The Board received regular reports from the various Group functions, including Investor Relations, Health, Safety and Environment, Corporate Affairs, Human Resources, Legal and Finance.

INDUCTION AND TRAINING

Following appointment to the Board, Directors receive a comprehensive induction tailored to their individual needs. This includes meetings with senior management to enable them to build up a detailed understanding of the Group's business and strategy, and the key risks and issues that it faces. During the year, for example, the new Chairman, Jorma Ollila, and Nick

Land, a new Non-executive Director, followed an in-depth induction programme, which involved comprehensive presentations and site visits to major operations for each of the businesses and functions on four continents. Additional training is available so that Directors can suitably update their skills and knowledge as appropriate.

ATTENDANCE AT BOARD AND BOARD COMMITTEE MEETINGS

The attendances of Directors during the year for all Board and Board Committee meetings are given in the table below.

	Board	Executive Committee	Audit Committee	Nomination & Succession Committee	Remuneration Committee	Social Responsibility Committee
Maarten van den Bergh	8/8					4/4
Malcolm Brinded	8/8	33/33				
Sir Peter Burt	2/3		2/3			
Linda Cook	8/8	33/33				
Nina Henderson	8/8		5/5			4/4
Aad Jacobs	3/3			2/2		
Sir Peter Job	7/8				5/5	
Lord Kerr of Kinlochard	8/8			5/5	5/5	
Wim Kok	8/8					4/4
Nick Land	4/4		2/2			
Aarnout Loudon	8/8			5/5	5/5	
Christine Morin-Postel	7/8		5/5			
Jorma Ollila	5/5			3/3		
Lawrence Ricciardi	8/8		5/5			
Rob Routs	8/8	33/33				
Jeroen van der Veer	8/8	33/33				
Peter Voser	8/8	33/33				

The first figure represents attendance and the second figure the possible number of meetings. For example 6/8 signifies a Director attended six out of a possible eight meetings. Where a Director was appointed to the Board or to a Board Committee during the year, only meetings after that date of appointment are shown.

EXECUTIVE COMMITTEE

The Executive Committee comprises the

- Chief Executive – Jeroen van der Veer;
- Executive Director, Exploration & Production – Malcolm Brinded;
- Executive Director, Gas & Power – Linda Cook;
- Executive Director, Oil Products and Chemicals – Rob Routs; and
- Chief Financial Officer – Peter Voser.

The Executive Committee operates under the direction of the Chief Executive and is responsible for Royal Dutch Shell's overall business and affairs. The Chief Executive has final authority in all matters of management that are not within the duties and authorities of the Board or of the AGM. The Executive Committee supports the Chief Executive and implements all Board resolutions and supervises all management levels in Royal Dutch Shell.

AUDIT COMMITTEE

The members of the Audit Committee are Lawrence Ricciardi (Chairman), Nick Land and Christine Morin-Postel, all of whom are financially literate independent Non-executive Directors. During the year, Sir Peter Burt retired as a committee member and as a Director at the AGM, Nick Land was appointed a member on July 1, and Nina Henderson rotated off as a member on October 25. For the purposes of the Combined Code Christine Morin-Postel qualifies as a person with "recent and relevant financial experience" and as an "audit committee financial expert" for the purposes of US securities laws. The Committee met five times during the year and Committee members' attendances are shown in the table on this page.

The key current responsibilities of the Audit Committee are to assist the Board in fulfilling its responsibilities in relation to internal control and financial reporting, to carry out certain oversight functions on behalf of the Board and to monitor compliance with applicable external legal and regulatory requirements, the Shell General Business Principles, the Shell Code of Conduct, and the Code of Ethics for Executive Directors and Senior Financial Officers. The Audit Committee reviews and assesses the remit of the internal audit function. It monitors and discusses whether our risk management and internal control system is effective, including any significant matters arising from the audits which are discussed with, as appropriate, the Chief Internal Auditor, management or the external auditors, PricewaterhouseCoopers LLP.

The Audit Committee monitors the qualifications, expertise, resources and independence of both the internal and external auditors and assesses each year the auditors' performance and effectiveness. The Audit Committee also establishes and monitors policies related to pre-approval of all services the external auditors provide. The Committee is responsible for establishing and monitoring the implementation of procedures for the receipt, retention and treatment of complaints regarding accounting, internal accounting controls, auditing or other matters, including mechanisms for the confidential or anonymous submission of related concerns by employees. This includes facilities to enable employees to submit concerns confidentially or anonymously, and to ensure independent investigation with follow-up action where suitable.

NOMINATION AND SUCCESSION COMMITTEE

The members of the Nomination and Succession Committee are Jorma Ollila (Chairman – with effect from June 1, 2006), Lord Kerr of Kinlochard and Aarnout Loudon. Aad Jacobs retired on May 31, 2006. The Committee met five times during the year and Committee Members' attendances are shown in the table on this page.

The Committee keeps under review the leadership needs of Royal Dutch Shell. It identifies and nominates suitable candidates for the Board's approval to fill vacancies as and when they arise.

The Committee also makes recommendations on who should be appointed chairman of the Audit Committee, the Remuneration Committee and the Social Responsibility Committee and, in consultation with the relevant chairman on the appointment of committee members. It makes recommendations on corporate governance guidelines for Royal Dutch Shell, monitors compliance with corporate governance requirements and makes recommendations on disclosures connected to corporate governance and its appointment processes.

During the year the Committee specifically handled a number of matters, including transition to the new Chairman, the succession to Sir Peter Burt and succession planning more generally. The Committee also undertook a review of Board Committee terms of reference and supervised the Board, Board Committee and Director Performance Appraisal process.

REMUNERATION COMMITTEE

The members of the Remuneration Committee are Aarnout Loudon (Chairman), Sir Peter Job and Lord Kerr of Kinlochard. The Committee met five times during the year. Committee Members' attendances are shown in the table on this page.

The Committee determines and agrees with the Board the remuneration policy for the Chairman, the Chief Executive and the Executive Directors and within the terms of this policy, determines the individual remuneration package for the Chairman, the Chief Executive and the Executive Directors. The Committee also considers and advises on the terms of any contract to be offered to a Director. It monitors the remuneration for other senior executives and makes suitable recommendations.

During the year, the Committee recommended individual remuneration packages for the Chief Executive, and, in consultation with the Chairman and the Chief Executive, other Executive Directors. The Committee also agreed with the Board performance targets for the remuneration of the Chief Executive and other Executive Directors.

Further information on the work of the Committee and details of the remuneration of all the Directors for the financial period ended December 31, 2006 are set out in the Directors' Remuneration Report.

SOCIAL RESPONSIBILITY COMMITTEE

The members of the Social Responsibility Committee are Wim Kok (Chairman), Maarten van den Bergh and Nina Henderson. The Committee met four times during the year, and Committee Members' attendance is shown on page 35.

The main role of the Committee is to review on behalf of the Board the Shell General Business Principles, the Shell Code of Conduct, the Health, Safety and Environment Policy, the principles relating to Sustainable Development and other major issues of public concern. The Committee does this by receiving reports and interviewing management on the Group's overall HSE and social performance, on the Group's annual performance against the Code of Conduct, on the management of social and environmental impacts at major projects and operations and on emerging social and environmental issues. It also provides input on and reviews the Shell Sustainability Report, including meeting face-to-face with the external report review committee. In addition to regular meetings, the Committee also visits Shell locations, meeting with local staff and external stakeholders to understand first-hand the site's operational performance, what relationships are like with the local community, with interested NGOs and with governments at the local and national levels, as relevant to the project. In particular, the Committee observes how the Group's standards are being implemented in practice and where in its judgement there might be areas for increased focus. In 2006, it visited the Group's natural gas projects in Corrib, Ireland and Pinedale, Wyoming, and the Motiva joint venture refinery in Port Arthur, Texas. It also visited New Orleans, Louisiana to see our contribution to the recovery of the city after the 2005 hurricanes. After each visit, the Committee reports its observations to the Executive Director responsible for that project or site and to the full Board.

The Committee reports on these topics and on its own conclusions and recommendations to executive management and the full Board.

BOARD EVALUATION

Performance evaluations of the Board, the Board Committees, the Chairman and each of the Directors were undertaken as set out in the table below. The full Board discussed the results of the evaluation of the Board and the Board Committees. The results of the evaluation of the Chairman, the Chief Executive and the Executive Directors were each discussed by the Non-executive Directors and the outcomes reported back to the Chairman, Chief Executive and Executive Directors respectively. The evaluation process is led by the Nomination and Succession Committee while the Deputy Chairman leads the evaluation of the Chairman.

RESULTS PRESENTATIONS AND ANALYSTS MEETINGS

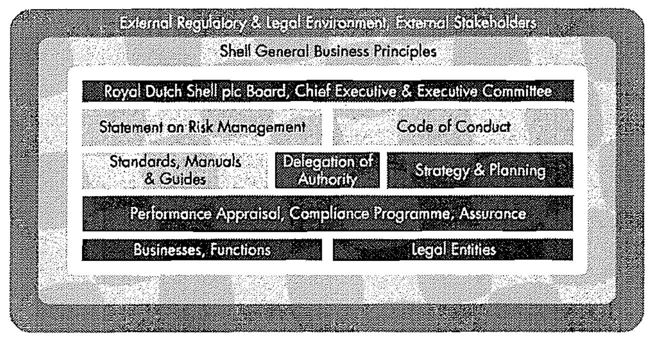
The quarterly and annual results presentations and all major analysts meetings are announced in advance on the Shell website and through a regulatory release. These presentations can be followed live via webcasting or tele-conference. Other meetings with analysts or investors are not normally announced in advance, nor can they be followed by webcast or any other means. Discussions in such meetings are always limited to information already in the public domain. This is in line with the requirement to ensure that all shareholders and other parties in the financial market have equal and simultaneous access to information which may influence the share price of Royal Dutch Shell. The Chairman, the Deputy Chairman, the Chief Executive, the Chief Financial Officer and the Executive Vice-President Investor Relations of Royal Dutch Shell report regularly to Directors on the views of major shareholders.

GOING CONCERN

The Directors consider that, taking into account the assets and income of the Group, Royal Dutch Shell has adequate resources to continue in operational existence for the foreseeable future. For this reason the Directors adopt the going concern basis for the Financial Statements contained in this Review.

SHELL CONTROL FRAMEWORK

The Board is responsible for the Group's system of internal control and for reviewing its effectiveness and has delegated authority to the Audit Committee to assist it in fulfilling its responsibilities in relation to internal control and financial reporting. A single overall control framework is in place which is designed to manage rather than eliminate the risk of failure to achieve business objectives, and only provides reasonable and not absolute assurance against material misstatement or loss. The Shell Control Framework applies to all wholly owned Shell companies and to those ventures and other companies where Royal Dutch Shell, directly or indirectly, has a controlling interest. The diagram below illustrates the Control Framework's key components, Foundations, Organisation and Processes.



Key: Foundations Organisation Processes

In "Foundations" we state the objectives, principles and rules that underpin and establish boundaries for the Shell Group's activities. "Organisation" sets out how the various legal entities involved relate to each other and how their business activities are organised and managed. "Processes" concerns the more material processes, including how authority is delegated, how strategy is set and plans are made and how performance and compliance are monitored, appraised and assured. All control activities relate to one or more of these components.

FURTHER INFORMATION

The following information is available on the Shell website www.shell.com/investor:

- the Terms of Reference of the Audit Committee, Nomination and Succession Committee, Remuneration Committee and Social Responsibility Committee explaining their roles and the authority the Board delegates to them;
- the full list of Matters reserved to the Board for decision;
- Shell General Business Principles;
- Shell Code of Conduct;
- Code of Ethics for Executive Directors and Senior Financial Officers; and
- Memorandum and Articles of Association.

Body to be evaluated	Method of Evaluation	Responsibility
Board[A]	Questionnaire completed by all Directors: Board discussion	Chairman
Board Committees	Questionnaire completed by all members: Committee discussion followed by Board discussion[B]	Relevant Committee Chairman
Chairman	Questionnaire completed by all Directors (except Chairman)[C] Board discussion (without Chairman)	Deputy Chairman
Non-executive Directors	One-to-one interviews with the Chairman	Chairman
Chief Executive	One-to-one interview between the Chairman and the Chief Executive (following discussion with Non-executive Directors)	Chairman
Executive Directors	Interview between the Chief Executive and each Executive Director followed by discussion with the Chairman and the Non-executive Directors	Chief Executive

[A] Includes overview of Board Committees.
[B] Separate questionnaires were prepared for each of the Board Committees.
[C] A separate questionnaire was prepared relating to the evaluation of the Chairman.

Summary Directors' Remuneration Report

This is a summary of the full Directors' Remuneration Report which can be found in the Annual Report and Form 20-F for the year ended December 31, 2006 and on the Shell website www.shell.com/annualreport.

EXECUTIVE DIRECTORS' REMUNERATION

The Remuneration Committee (REMCO) is committed to the principles of pay for performance, competitiveness, shareholding, consistency and compliance. It bases remuneration policies and decisions for Executive Directors on these principles.

The Executive Directors' compensation package is made up of base pay, annual bonus, long-term incentives, pension and other benefits.

Actual total direct compensation of Executive Directors in office during 2006

	Jeroen van der Veer	Malcolm Brinded	Linda Cook	Rob Routs	Peter Voser
Total emoluments	3,694,211	2,411,346	2,261,234	2,169,168	2,048,441
Share option gains	286,843	–	584,257	287,643	–
Pension benefits[A]	1,458,000	56,162	1,087,034[B]	276,000	498,498
Total compensation in €	5,439,054	2,467,508	3,932,525	2,732,811	2,546,939
Total compensation in $	6,879,757	3,121,104	4,974,176	3,456,681	3,221,576
Total compensation in £	3,707,551	1,681,985	2,680,620	1,862,830	1,736,130

[A] The value of the retirement benefits is based on transfer values

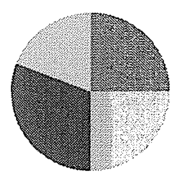
[B] For Linda Cook, employer contributions to defined contribution plans of $238,430 made during 2006 are included.

EXECUTIVE DIRECTORS' 2006 EARNINGS

Base pay is set at a competitive level, relevant to the scope and complexity of the roles of Chief Executive and Executive Director, and reflects the reporting structure in the Executive Committee. Base pay levels are set in euro and benchmarked against the oil majors (BP, Chevron, ExxonMobil and Total) and a single grouping of top European-based companies, including a selection of FTSE and AEX companies. REMCO endorsed Executive Directors' base pay increases in 2006 as follows: Jeroen van der Veer 9.7%, Malcolm Brinded 2.4%, Linda Cook 10.0%, Rob Routs 3.2% and Peter Voser 10.0%. These increases were made in order to sustain the current market position of these levels, recognising normal market movements.

The annual bonus is designed to reward Executive Directors for achieving results that further Shell's objectives and is determined in accordance with the stretching but realistic financial, operational and sustainable development targets in the Shell Group Scorecard. At the end of the financial year, results are translated into an overall score between a minimum of zero and a maximum of two. Bonus awards are based on this score multiplied by the target bonus level. REMCO uses its judgement to make a final determination.

SHELL GROUP SCORECARD COMPONENTS



- 25% Operational Cash Flow
- 25% Total Shareholder Return (TSR) against major integrated oil companies
- 30% Operational excellence in each of the businesses
- 20% Sustainable development[A]

[A] Primarily based on number of reported cases of work-related injury, but also including other Sustainable Development measures, details of which can be found in the Shell Sustainability Report.

EARNINGS OF EXECUTIVE DIRECTORS IN OFFICE DURING 2006 (The information in this table has been audited) €

	Jeroen van der Veer		Malcolm Brinded		Linda Cook		Rob Routs		Peter Voser	
	2006	2005	2006	2005	2006	2005	2006	2005	2006	2005
Salaries	1,625,000	1,525,000	1,062,500	1,041,454	885,112	834,294	940,000	912,500	892,500	822,099
Bonus[A]	2,040,000[B]	1,937,500	1,290,000[B]	1,312,500	1,122,000[B]	1,062,500	1,146,000[C]	1,156,250	1,122,000[B]	1,062,500
Cash benefits	15,840[D]	16,632	8,340[E]	19,674	173,814[F]	290,049[G]	42,903[H]	69,919	16,428[I]	117,285
Total cash	**3,680,840**	3,479,132	**2,360,840**	2,373,628	**2,180,926**	2,186,843	**2,128,903**	2,138,669	**2,030,928**	2,001,884
Car benefit[J]	–	–	22,049	21,906	24,006	23,531	35,108	34,454	–	–
Other benefits[K]	13,371[L]	5,114	28,457	2,301	56,302[L]	43,691	5,157	5,114	17,513	3,856
Total emoluments in euro	**3,694,211**	3,484,246	**2,411,346**	2,397,835	**2,261,234**	2,254,065	**2,169,168**	2,178,237	**2,048,441**	2,005,740
Total emoluments in US dollar	**4,672,739**	4,331,484	**3,050,066**	2,986,152	**2,860,192**	2,802,170	**2,743,740**	2,707,903	**2,591,035**	2,479,632
Total emoluments in sterling	**2,518,173**	2,383,129	**1,643,703**	1,637,486	**1,541,378**	1,541,719	**1,478,621**	1,489,855	**1,396,327**	1,368,847

Data in all tables is converted from the currency in which it is set to euro, sterling and US dollar as appropriate.

The aggregate amount of emoluments paid to or receivable by Executive Directors of Royal Dutch Shell and other Shell Group companies for services in all capacities during the fiscal year ended December 31, 2006, was €12,584,400 (2005: €12,320,123)

[A] The annual bonus figures are shown in the table in their related performance year and not in the following year in which they are paid

[B] Of which 50% will be deferred under the Deferred Bonus Plan.

[C] Of which 40% will be deferred under the Deferred Bonus Plan.

[D] Includes a representation allowance, the employer's contribution to a health insurance plan and a car allowance.

[E] Includes a representation allowance and the employer's contribution to a health insurance plan.

[F] Includes a representation allowance, school fees, the employer's contribution to a health insurance plan, and tax compensation and reimbursements.

[G] The tax compensation amounts reported in 2005 have been revised downwards to reflect actual amounts payable.

[H] Includes a representation allowance, the employer's contribution to a health insurance plan and school fees.

[I] Includes a representation allowance, the employer's contribution to a health insurance plan, a car allowance and the balance of a settling-in allowance.

[J] The car benefit is stated at the value employed by the Fiscal Authorities in the Netherlands for company-provided vehicles and based on the original purchase price.

[K] Comprises social security premiums paid by the employer, as well as a provision for company-provided transport for home to office commuting.

[L] During their tenure with Shell Oil Company in the US, Jeroen van der Veer and Linda Cook received a one-time company-owned life insurance benefit, the incremental value of which is included.

The target level of the 2006 bonus was 100% of base pay for Executive Directors. Taking into account the result of the 2006 Shell Group Scorecard process, REMCO used discretion to determine that the annual bonuses payable to Executive Directors for 2006 would be 120% of base pay. The target levels for Executive Director bonuses for 2007 will be 110% of base pay, and 120% for the Chief Executive.

LONG-TERM INCENTIVES

Long-term incentives ensure a closer link between Executive Directors' pay and the Shell Group's performance compared to its peers. Relative Total Shareholder Return (TSR) is the performance test that most closely aligns the interests of Executive Directors with those of shareholders. Under the Long-Term Incentive Plan (LTIP) and Deferred Bonus Plan (DBP) conditional performance shares are only released if the performance condition is met. REMCO will retain discretion to adjust the levels of release depending on its judgement of the underlying performance of the Shell Group.

Under the LTIP, awards consisting of performance shares are made conditionally once a year and will have a face value between zero and two and a half times base pay. The current schedule of awards is as follows:

TSR rank	Final number of performance shares
1st	2 x award
2nd	1.5 x award
3rd	0.8 x award
4th or 5th	Nil

During 2006 the face value of conditional awards made were 2.4 times base pay for the Chief Executive and 2.2 times base pay for the other Executive Directors. The actual number of shares received in 2009 will depend on TSR performance over the period 2006 to 2008.

The DBP encourages share ownership by allowing Executive Directors to invest part of their annual bonus in Royal Dutch Shell shares. Under the plan, Executive Directors can choose to invest up to 50% of their annual bonus in deferred bonus shares. For the 2006 financial year Executive Directors were required to defer 25% of their bonus into deferred bonus shares. Any dividends payable on these deferred bonus shares are accrued as dividend shares. Provided the Executive Director remains employed by Shell for three years following the year in which the bonus was earned, he or she will receive one matching share for every four deferred bonus and dividend shares. Additional performance-related matching shares can be earned as follows:

TSR rank	Number of performance-related matching shares (per every 4 deferred bonus shares)
1st	3
2nd	2
3rd	1
4th or 5th	Nil

The deferred bonus shares, dividend shares and matching shares are released three years after the end of the year in which the annual bonus was earned. Jeroen van der Veer and Malcolm Brinded deferred 50% of their 2005 bonus into the DBP in 2006 and Peter Voser deferred 25%. The 2003 award, under the previous DBP relating to the 2002 bonus, was released to Jeroen van der Veer and Malcolm Brinded in February 2006, including additional matching shares (equivalent to 19,339 and 14,432 Royal Dutch Shell plc Class A shares after tax, respectively).

The aggregate expected value of shares awarded to the Executive Directors under the LTIP during 2006 was $12,989,778 and the aggregate amount of gains derived from exercising share options during the year was $1,437,935.

PENSIONS

Taking account of developments in age discrimination legislation in jurisdictions relevant to Royal Dutch Shell, REMCO decided to depart from a policy of mandatory retirement at a particular age for Executive Directors. REMCO will agree retirement schedules with Executive Directors to retire as appropriate to plan effective executive leadership succession, taking into account applicable legislation and the individual's preferences.

Retirement benefit arrangements for Executive Directors are based on local market practices and the overall value of the remuneration package necessary to attract and retain high-calibre individuals. Under these arrangements only the base pay is pensionable except in relation to Linda Cook. In line with standard US market practice under the US plans, Linda Cook's annual bonus is also pensionable. Contribution rates for Executive Directors are the same as for other employees under these plans. Under the US defined benefit plans, employee contributions are not required.

In the UK, new statutory limits on future tax-advantaged pension accrual for employees with UK pension benefits were introduced from April 6, 2006. Malcolm Brinded's entitlements in the Shell Overseas Contributory Pension Fund are not affected by these changes. His past service entitlements within the SCPF will, however, be covered by his participation in the SSPP which is a supplementary, unfunded, employer sponsored retirement benefit scheme. Changes to Swiss pension law introduced a cap on insured benefits leading to a surplus in accrued rights for Peter Voser. In order to continue to offer him similar retirement benefits as the other Executive Directors, a supplementary defined benefit plan will be established to deliver the balance of pension in retirement.

During 2006, Jeroen van der Veer, Malcolm Brinded, Linda Cook, Rob Routs and Peter Voser accrued retirement benefits under defined benefit plans.

SHAREHOLDINGS

Executive Directors are expected to build up shareholdings to the value of two times their base pay over five years. Until the target is met, they are required to retain 50% of the shares received through the release of LTIP awards and matching shares under the DBP granted in 2005 onwards. Once the target is met they are required to hold the shares and maintain that level for the full period of their appointment as Executive Directors.

EXECUTIVE DIRECTORS' CONTRACTS OF SERVICE

Contracts for Executive Directors are governed by Dutch law. They contain similar terms and conditions and are consistent with those for other Netherlands-based senior executives. Under Dutch law, their contracts entitle them to the statutory notice period that applies for employees in the Netherlands. This is one month for an employee and up to a maximum of four months for the employer, depending on the duration of the employment contract concerned at the time of termination. The contracts end by notice of either party or automatically at retirement.

Jeroen van der Veer and Rob Routs stood for re-election at the Annual General Meeting of 2006. Malcolm Brinded and Linda Cook will stand for re-election at the AGM of 2007 and Peter Voser at the AGM of 2008. Rob Routs' contract was extended to December 31, 2008 to provide stability and continuity to the Downstream business strategy.

In order to retain the services of Rob Routs to December 31, 2008, he has been offered a lump sum payment to be paid upon retirement. This amount represents the net present value of the difference in the pension accrued under the prevailing pension fund rules and the amount which he would have accrued by December 31, 2008 had he retired as originally scheduled, at age 60.

Standard Executive Directors' contracts do not contain any predetermined settlements for early termination. REMCO will recommend terms and conditions for any situation where severance payment is appropriate, taking into consideration applicable law and corporate governance provisions. Temporary severance arrangements may be agreed to help the recruitment process if Executive Directors are appointed from outside the Shell Group. Peter Voser's contract includes a temporary severance arrangement if his employment is terminated under certain conditions before October 4, 2007. His severance pay would be equal to his gross annual base pay plus his most recent bonus, but in no event less than €1,500,000.

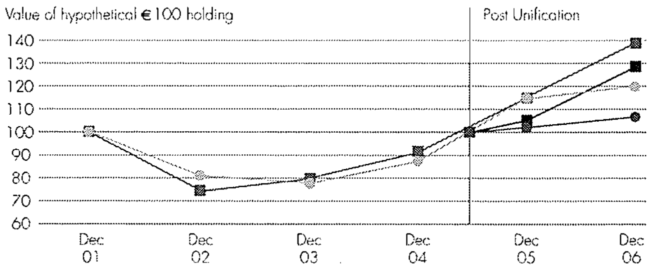
PERFORMANCE GRAPH

The graphs compare, on the basis required by Schedule 7A of the Companies Act 1985, the TSR of Royal Dutch Shell and that of the companies comprising the Euronext 100 share index and the FTSE 100 share index. The first graph compares Royal Dutch shares and subsequently Royal Dutch Shell plc Class A shares as listed at the Euronext Exchange over the five year period from 2002 to 2006 against the Euronext 100 share index. It also includes a comparison of Royal Dutch Shell Class A shares as listed at the Euronext Exchange from July 20, 2005 to Euronext 100 share index.

The second graph compares, similarly, Shell Transport shares and subsequently Royal Dutch Shell plc Class B shares as listed at the London Stock Exchange over the five year period from 2002 to 2006 against the FTSE 100 share index. Also included is a comparison of Royal Dutch Shell plc Class B shares as listed at the London Stock Exchange from July 20, 2005 to the FTSE 100 share index. The Board regards the Euronext 100 and the FTSE 100 share indices as an appropriate broad market equity index for comparison, as they are the leading market indices in Royal Dutch Shell's home markets.

HISTORICAL TSR PERFORMANCE OF ROYAL DUTCH SHELL plc CLASS A

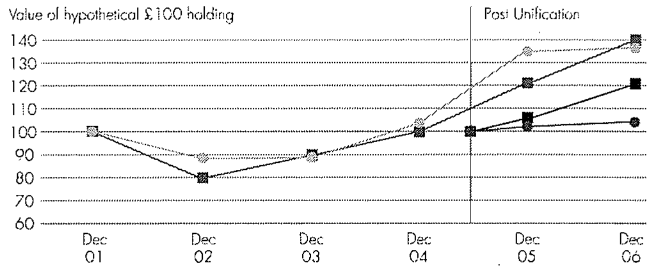
Growth in value of a hypothetical €100 holding over five years both before and since the Unification Transaction on July 20, 2005. Euronext 100 comparison based on 30 trading day average values (averaged forward from the Unification Transaction and backwards from year end).



KEY: Royal Dutch Shell plc Class A ● Royal Dutch Shell plc Class A *Post Unification*
Euronext 100 ■ Euronext 100 *Post Unification*

HISTORICAL TSR PERFORMANCE OF ROYAL DUTCH SHELL plc CLASS B

Growth in value of a hypothetical £100 holding over five years both before and since the Unification Transaction on July 20, 2005. FTSE100 comparison based on 30 trading day average values (averaged forward from the Unification Transaction and backwards from year end).



KEY: Royal Dutch Shell plc Class B ● Royal Dutch Shell plc Class B *Post Unification*
FTSE100 ■ FTSE100 *Post Unification*

NON-EXECUTIVE DIRECTORS

REMUNERATION POLICY

The Board determines the remuneration of all Non-executive Directors of Royal Dutch Shell, within a limit specified by the Articles of Association. The annual limit was set at £2,500,000 ($4,630,500). In 2006, the total amount of fees to Royal Dutch Shell Non-executive Directors was £1,208,109 ($2,241,776).

To date Non-executive Directors' fees have been set in sterling. From 2007, the base currency will change from sterling to euro. Where the fee level set for the Chairman of the Board was £500,000[A] ($926,100) in 2006, this will be €750,000 for 2007. All Non-executive Directors of Royal Dutch Shell are paid an annual fee of £70,000 ($129,654). The Senior Independent Director, Lord Kerr of Kinlochard, receives an additional fee of £30,000 ($55,566). For 2007 these fees will be €105,000 and €45,000, respectively.

Committee Chairman and Committee fees for 2006 and 2007 are shown in the table below. Non-executive Directors are paid an additional fee of £3,000 ($5,557[A]) for any meeting involving intercontinental travel, although there will be no payment for one meeting per year requiring intercontinental travel, held in a location other than The Hague. From 2007 this will be €4,500.

NON-EXECUTIVE DIRECTORS' PENSION INTEREST

Non-executive Directors do not accrue any retirement benefits as a result of their Non-executive Directorships with Royal Dutch Shell. During his service as a Managing Director for the Shell Group, Maarten van den Bergh accrued retirement benefits under the Shell Petroleum Company Limited Managing Directors' Pension Scheme.

APPOINTMENTS

In accordance with the Combined Code, Non-executive Directors are appointed for specified terms of office, subject to the provisions of the Articles of Association regarding their election and re-election at the Annual General Meeting. Non-executive Directors' appointments are subject to three months' notice and there is no compensation provision for early termination.

Jorma Ollila and Nick Land were appointed to the Board of Royal Dutch Shell plc during 2006. Their terms of appointment will run until the 2009 AGM. The remaining Non-executive Directors terms of appointment run until the close of business of the Annual General Meeting in 2007. A copy of the standard letter of appointment for Non-executive Directors can be obtained from the Company Secretary.

COMPENSATION OF DIRECTORS AND SENIOR MANAGEMENT

Compensation of $21,472,979 was paid and/or accrued for services in all capacities provided by Directors and Senior Management of Royal Dutch Shell during the fiscal year ended December 31, 2006. A further amount of $5,064,894 (excluding inflation) was accrued to provide pension, retirement and similar benefits.

Signed on behalf of the Board

Michiel Brandjes
Company Secretary
March 7, 2007

FEES OF NON-EXECUTIVE DIRECTORS OF ROYAL DUTCH SHELL FOR 2006 and 2007

	Additional annual committee Chairman's fee[B] 2006			2007	Additional annual member's fee[A] 2006			2007
Committee name	£	€	$	€	£	€	$	€
Audit Committee	25,000	36,659	46,305	37,500	15,000	21,995	27,783	22,500
Remuneration Committee	20,000	29,327	37,044	30,000	11,500	16,863	21,300	17,250
Social Responsibility Committee	15,000	21,995	27,783	30,000[C]	8,000	11,731	14,818	17,250[C]
Nomination and Succession Committee	15,000	21,995	27,783	22,500[A]	8,000	11,731	14,818	12,000

[A] Mr Ollila has the use of an apartment when on business in The Hague. He receives no additional payments for chairing the Nomination and Succession Committee

[B] The Chairman of a committee of the Board does not receive an additional fee for membership of that committee.

[C] Effective January 1, 2007, the fees for the Chairman and members of the Social Responsibility Committee will be €30,000 (£20,000) and €17,250 (£11,500) respectively. This adjustment reflects the increasingly demanding role of the Committee

Summary Consolidated Financial Statements

These Summary Consolidated Financial Statements are an abridged version of the Consolidated Financial Statements of the Royal Dutch Shell Group and of the Directors' Remuneration Report for 2006. They do not contain sufficient information to allow for a full understanding of the results and the state of affairs of the Royal Dutch Shell Group, and of its policies and of arrangements concerning Directors' remuneration. The auditors' report on the Consolidated Financial Statements and the auditable part of the Directors' Remuneration Report was unqualified. For further information consult the full 2006 Annual Report and Form 20-F at www.shell.com/annualreport, or request a free copy from the address on the back cover.

SUMMARY CONSOLIDATED STATEMENT OF INCOME — $ million

	2006	2005	2004
Revenue			
Exploration & Production	17,909	23,970	18,400
Gas & Power	15,887	13,766	9,625
Oil Products	248,581	237,210	210,424
Chemicals	36,306	31,018	26,877
Other industry segments and Corporate	162	767	1,060
Total	318,845	306,731	266,386
Cost of sales	262,989	252,622	223,259
Gross profit	55,856	54,109	43,127
Selling, distribution and administrative expenses	16,616	15,482	15,098
Exploration	1,562	1,286	1,809
Share of profit of equity accounted investments	6,671	7,123	5,015
Interest and other income	1,428	1,171	1,483
Interest expense	1,149	1,068	1,059
Income before taxation	44,628	44,567	31,659
Taxation	18,317	17,999	12,168
Income from continuing operations	26,311	26,568	19,491
Income/(loss) from discontinued operations	–	(307)	(234)
Income for the period	26,311	26,261	19,257
Income attributable to minority interest	869	950	717
Income attributable to shareholders of Royal Dutch Shell plc	25,442	25,311	18,540
Research and development expenditure included in cost of sales	885	588	553

EARNINGS PER SHARE — $

	2006	2005	2004
Basic earnings per share	3.97	3.79	2.74
Continuing operations	3.97	3.84	2.77
Discontinued operations	–	(0.05)	(0.03)
Diluted earnings per share	3.95	3.78	2.74
Continuing operations	3.95	3.83	2.77
Discontinued operations	–	(0.05)	(0.03)

SUMMARY CONSOLIDATED BALANCE SHEET

$ million	Dec. 31, 2006	Dec 31, 2005
Assets		
Non-current assets		
Intangible assets	4,808	4,350
Property, plant and equipment	100,988	87,558
Investments:		
equity accounted investments	20,740	16,905
financial assets	4,493	3,672
Deferred tax	2,968	2,562
Prepaid pension costs	3,926	2,486
Other	5,468	4,091
	143,391	121,624
Current assets		
Inventories	23,215	19,776
Accounts receivable	59,668	66,386
Cash and cash equivalents	9,002	11,730
	91,885	97,892
Total assets	235,276	219,516
Liabilities		
Non-current liabilities		
Debt	9,713	7,578
Deferred tax	13,094	10,763
Retirement benefit obligations	6,096	5,807
Other provisions	10,355	7,385
Other	4,325	5,095
	43,583	36,628
Current liabilities		
Debt	6,060	5,338
Accounts payable and accrued liabilities	62,556	69,013
Taxes payable	6,021	8,782
Retirement benefit obligations	319	282
Other provisions	1,792	1,549
	76,748	84,964
Total liabilities	120,331	121,592
Equity attributable to shareholders of Royal Dutch Shell plc	105,726	90,924
Minority interest	9,219	7,000
Total equity	114,945	97,924
Total liabilities and equity	235,276	219,516

/s/ Peter Voser

Peter Voser
Chief Financial Officer, for and on behalf of the Board of Directors

March 7, 2007

SUMMARY CONSOLIDATED STATEMENT OF CHANGES IN EQUITY

$ million

	Equity attributable to shareholders of Royal Dutch Shell plc	Minority interest	Total equity
At January 1, 2004	73,535	3,408	76,943
Income for the period	18,540	717	19,257
Income/(expense) recognised directly in equity	2,807	609	3,416
Dividends paid	(7,391)	(264)	(7,655)
Other changes	(1,421)	843	(578)
At December 31, 2004	86,070	5,313	91,383
IAS 32/39 transition	796	–	796
At January 1, 2005			
(after IAS 32/39 transition)	86,866	5,313	92,179
Income for the period	25,311	950	26,261
Income/(expense) recognised directly in equity	(4,366)	106	(4,260)
Dividends paid	(10,556)	(293)	(10,849)
Other changes	(6,331)	924	(5,407)
At December 31, 2005	90,924	7,000	97,924
Income for the period	25,442	869	26,311
Income/(expense) recognised directly in equity	4,671	38	4,709
Dividends paid	(8,142)	(289)	(8,431)
Other changes	(7,169)	1,601	(5,568)
At December 31, 2006	105,726	9,219	114,945

SUMMARY CONSOLIDATED STATEMENT OF CASH FLOWS

$ million

	2006	2005	2004
Cash flow from operating activities:			
Income for the period	26,311	26,261	19,257
Adjustment for:			
Current taxation	17,338	19,435	13,081
Interest (income)/expense	716	632	803
Depreciation, depletion and amortisation	12,615	11,981	12,845
(Profit)/loss on sale of assets	(571)	(1,313)	(3,087)
Decrease/(increase) in net working capital	(4,052)	(5,664)	(4,062)
Share of profit of equity accounted investments	(6,671)	(7,123)	(5,015)
Dividends received from equity accounted investments	5,488	6,709	4,190
Deferred taxation and other provisions	1,833	(1,515)	(1,007)
Other	(266)	(47)	292
Cash flow from operating activities (pre-tax)	52,741	49,356	37,297
Taxation paid	(21,045)	(19,243)	(10,760)
Cash flow from operating activities	31,696	30,113	26,537
Cash flow from investing activities:			
Capital expenditure	(22,922)	(15,904)	(13,566)
Investments in equity accounted investments	(851)	(705)	(1,058)
Proceeds from sale of assets	1,611	2,310	5,142
Proceeds from sale of equity accounted investments	282	4,313	1,316
Proceeds from sale of/(additions to) financial assets	22	362	1,739
Interest received	997	863	463
Cash flow from investing activities	(20,861)	(8,761)	(5,964)
Cash flow from financing activities:			
Net increase/(decrease) in debt with maturity period within three months	75	(956)	8
Other debt:			
New borrowings	4,263	2,130	2,121
Repayments	(2,232)	(2,656)	(6,380)
Interest paid	(1,296)	(1,124)	(962)
Change in minority interest	1,434	1,143	812
Net issue/(repurchase) of shares	(8,047)	(4,988)	(777)
Dividends paid to:			
Shareholders of Royal Dutch Shell plc	(8,142)	(10,556)	(7,391)
Minority interest	(289)	(293)	(264)
Payments to former Royal Dutch shareholders	–	(1,651)	–
Treasury shares: net sales/(purchases) and dividends received	493	378	(759)
Cash flow from financing activities	(13,741)	(18,573)	(13,592)
Currency translation differences relating to cash and cash equivalents	178	(250)	113
Increase/(decrease) in cash and cash equivalents	(2,728)	2,529	7,094
Cash and cash equivalents at January 1	11,730	9,201	2,107
Cash and cash equivalents at December 31	9,002	11,730	9,201

Notes to the Summary Consolidated Financial Statements

1

NATURE OF THE SUMMARY CONSOLIDATED FINANCIAL STATEMENTS

The Summary Consolidated Financial Statements have been derived from the Consolidated Financial Statements of Royal Dutch Shell plc and its consolidated subsidiaries (collectively known as the "Shell Group"). These financial statements give retroactive effect for all periods presented to the Unification whereby, on July 20, 2005 Royal Dutch Shell plc became the parent company of Royal Dutch Petroleum Company and The "Shell" Transport and Trading Company, p.l.c.

The Consolidated Financial Statements have been prepared in accordance with the provisions of the Companies Act 1985, Article 4 of the International Accounting Standards (IAS) Regulation and with International Financial Reporting Standards (IFRS) as adopted by the European Union. As applied to Royal Dutch Shell, there are no material differences with IFRS as issued by the International Accounting Standards Board.

The Consolidated Financial Statements are presented in US dollars ("dollars") and include the accounts of Royal Dutch Shell plc and of those companies in which it, either directly or indirectly, has control either through a majority of the voting rights or the right to exercise a controlling influence or to obtain the majority of the benefits and be exposed to the majority of the risks. Investments in companies over which Shell Group companies have significant influence but not control are classified as associated companies and are accounted for on the equity basis. Interests in jointly controlled entities are also recognised on the equity basis. Interests in jointly controlled assets are recognised by including the Shell Group share of assets, liabilities, income and expenses on a line-by-line basis.

Assets and liabilities of non-dollar Shell Group companies are translated to dollars at year-end rates of exchange, while their statements of income and cash flows are translated at quarterly average rates. Translation differences arising on consolidation are taken directly to a currency translation differences account within equity. Upon divestment or liquidation of an entity, cumulative currency translation differences related to that entity are taken to income.

2

SEGMENT EARNINGS

			$ million
	2006	2005	2004
Exploration & Production	15,195	14,238	9,823
Gas & Power	2,650	1,573	1,815
Oil Products	7,125	9,982	7,597
Chemicals	1,064	991	1,148
Other industry segments and Corporate	277	(523)	(1,126)
Income for the period	26,311	26,261	19,257

Operating segment results are presented above as appraised by management on the basis of income including share of profit from equity accounted investments, certain interest and other income and interest expense and income from discontinued operations and after tax. A reconciliation to segment results presented in accordance with IAS 14 "Segment Reporting" is provided in the Annual Report and Form 20-F for the year ended December 31, 2006.

3

DIVIDENDS

			$ million
	2006	2005	2004
Interim dividends paid: €0.98 per Class A share (2005: €1.21; 2004: €0.89)	4,726	6,241	4,580
Interim dividends paid: €0.98 per Class B share (2005: €1.23; 2004: €0.81)	3,416	4,315	2,809
Shell Transport preference dividends paid per share: Nil (2005: Nil; 2004: 7.00 pence)	–	–	2
	8,142	10,556	7,391

In addition, on February 1, 2007 the Directors proposed a further interim dividend in respect of 2006 of €0.25 per Class A share and €0.25 per Class B share, payable on March 14, 2007, which will absorb an estimated $2,125 million of shareholders' funds.

4

REMUNERATION OF DIRECTORS AND SENIOR MANAGEMENT

			$ thousands
	2006	2005	2004
Short-term employee benefits[A]	15,917	14,361	10,801
Post-employment benefits[B]	2,125	4,278	1,034
Other long-term benefits[C]	4,105	2,350	838
Share-based payments[D]	13,879	5,111	3,691
	36,026	26,100	16,364

[A] In addition to salaries and fees, this includes annual bonus (shown in the related performance year and not in the following year in which they are paid), cash benefits, car benefits and other benefits such as Medicare contributions and social law taxes.
[B] The amounts contributed by the Shell Group to pension funds. 2005 includes a one-off payment of $2.6 million made on behalf of Peter Voser to the Shell Swiss Expatriate Pension Fund.
[C] The annual bonus deferred under the Deferred Bonus Plan.
[D] Cost to the Group of Directors and Senior Management participation in share-based payment plans and realised gains on exercise of share options.

In 2004 and 2005, Directors and Senior Management comprise the Executive and Non-executive Directors of Royal Dutch Shell. In 2006, one member of Senior Management was appointed.

There were no termination benefits in 2006, 2005 and 2004.

Aggregate Directors' emoluments in respect of qualifying services to Royal Dutch Shell are $18.2 million (2005: $7.9 million, 2004: Nil) of which $11.7 million (2005: $4.6 million, 2004: Nil) relates to emoluments receivable in respect of services to the Parent Company.

5

POST BALANCE SHEET EVENTS

Since December 31, 2006 additional purchases of shares have been made under the Company's buyback programme. At March 1, 2007 a further 14,220,000 Class A shares (representing 0.2% of Royal Dutch Shell's issued share capital at December 31, 2006) had been purchased for cancellation at a total cost of $486 million including expenses, at an average price of €26.21 and 1,732.81 pence per Class A share.

Independent Auditors' Statement to the members of Royal Dutch Shell plc

We have examined the Summary Consolidated Financial Statements of Royal Dutch Shell plc, which comprises the Summary Consolidated Income Statement, the Summary Consolidated Balance Sheet, the Summary Consolidated Statement of Changes in Equity, the Summary Consolidated Statement of Cash Flows and the Summary related notes, together with the Summary Directors' Remuneration Report.

RESPECTIVE RESPONSIBILITIES OF DIRECTORS AND AUDITORS

The directors are responsible for preparing the Annual Review and Summary Financial Statements in accordance with United Kingdom law. Our responsibility is to report to you our opinion on the consistency of the Summary Consolidated Financial Statements with the full Consolidated Financial Statements, the Report of the Directors and the Directors' Remuneration Report, and its compliance with the relevant requirements of section 251 of the Companies Act 1985 and the regulations made thereunder. We also read the other information contained in the Annual Review and Summary Financial Statements and consider the implications for our report if we become aware of any apparent misstatements or material inconsistencies with the Summary Consolidated Financial Statements.

This statement, including the opinion, has been prepared for and only for the Company's members as a body in accordance with section 251 of the Companies Act 1985 and for no other purpose. We do nor, in giving this opinion, accepr or assume responsibility for any other purpose or to any other person to whom this statement is shown or into whose hands it may come save where expressly agreed by our prior consent in writing.

BASIS OF OPINION

We conducted our work in accordance with Bulletin 1999/6 "The auditors' statement on the summary financial statement" issued by the Auditing Practices Board. Our report on the Company's full Consolidated Financial Statements describes the basis of our audit opinion on those financial statements and on the parts of the Directors' Remuneration Report that are subject to audit.

OPINION

In our opinion the Summary Consolidated Financial Statements are consistent with the full Consolidated Financial Statements, the Report of the Directors and the Directors' Remuneration Report of Royal Dutch Shell plc for the year ended December 31, 2006 and comply with the applicable requirements of section 251 of the Companies Act 1985 and the regulations made thereunder.

PricewaterhouseCoopers LLP
Chartered Accountants and Registered Auditors
London
March 7, 2007

The Report of the Independent Auditors on the Consolidated Financial Statements for the year ended December 31, 2006 was unqualified and did not include a statement under either Section 237(2) (accounting records or returns inadequate or accounts not agreeing with records and returns) or Section 237(3) (failure to obtain necessary information and explanations) of the Companies Act 1985.

NOTES

[A] The maintenance and integrity of the Royal Dutch Shell plc website is the responsibility of the directors; the work carried out by the auditors does not involve consideration of these matters and, accordingly, the auditors accept no responsibility for any changes that may have occurred to the financial statements since they were initially presented on the website.

[B] Legislation in the United Kingdom governing the preparation and dissemination of financial statements may differ from legislation in other jurisdictions.

Supplementary information

PROVED OIL AND NATURAL GAS RESERVES[A][B][C] (At December 31)			million barrels of oil equivalent[D]
	2006	2005	2004
Group companies	8,452	7,761	8,064
Group share of equity accounted investments	3,355	3,705	3,818

OIL SANDS[B] (At December 31)			million barrels
	2006	2005	2004
Group companies	1,134	746	615

[A] Estimated net proved developed and undeveloped oil and natural gas reserves

[B] Petroleum reserves from operations that do not qualify as oil and gas producing activities, such as our Athabasca Oil Sands Project, are not included

[C] For this purpose natural gas has been converted to barrels of oil equivalent using a factor of 5,800 standard cubic feet per barrel.

[D] Although presented separately, management regards reserves obtained from equity accounted investments on an equal basis to those obtained from Group companies. Proved developed and undeveloped reserves of Group companies and Group share of equity accounted investments equalled 11,807 million boe at December 31, 2006 (2005: 11,466 million boe and 2004: 11,882 million boe). Additionally, management considers proven mining reserves (oil sands) on an equal basis to oil and gas reserves.

CAPITAL INVESTMENT			$ million
	2006	2005	2004
Exploration & Production	17,944	12,046	9,708
Gas & Power	2,200	1,602	1,633
Oil Products	3,457	2,844	2,823
Chemicals	877	599	868
Other industry segments and Corporate	418	345	243
Total	24,896	17,436	15,275

Operational Data

CRUDE OIL AND NATURAL GAS LIQUIDS PRODUCTION			
(including equity accounted investments and excluding oil sands)		thousand barrels daily	
	2006	2005	2004
Europe	496	541	580
Other Eastern Hemisphere	1,036	1,044	1,113
USA	322	333	375
Other Western Hemisphere	94	80	105
Total	1,948	1,998	2,173

NATURAL GAS PRODUCTION AVAILABLE FOR SALE			
(including equity accounted investments)		million standard cubic feet (scf) daily	
	2006	2005	2004
Europe	3,523	3,659	3,739
Other Eastern Hemisphere	3,167	2,955	3,198
USA	1,163	1,150	1,332
Other Western Hemisphere	515	499	539
Total	8,368	8,263	8,808

REFINERY PROCESSING INTAKE			
		thousand barrels daily	
	2006	2005	2004
Europe	1,732	1,804	1,770
Other Eastern Hemisphere	808	849	962
USA	956	953	1,055
Other Western Hemisphere	366	375	375
Total	3,862	3,981	4,162

LIQUEFIED NATURAL GAS (LNG)			
			million tonnes
	2006	2005	2004
Global equity LNG sales volume	12.1	10.7	10.2

OIL SALES			
			thousand barrels
	2006	2005	2004
Gasolines	2,206	2,404	2,760
Kerosines	749	811	833
Gas/diesel oils	2,106	2,296	2,398
Fuel oil	747	844	849
Other products	677	702	760
Total oil products	6,485	7,057	7,600
Crude oil	2,472	3,695	5,160
Total	8,957	10,752	12,760

CHEMICAL SALES VOLUMES BY MAIN CATEGORY			
			thousand tonnes
	2006	2005	2004
Base chemicals	14,146	13,710	14,184
First-line derivatives	8,964	8,891	9,499
Other	27	225	477
Total	23,137	22,826	24,160

Shareholder information

ANNUAL GENERAL MEETING

The Annual General Meeting of Royal Dutch Shell plc will be held at the Circustheater, Circusstraat 4 in The Hague, the Netherlands at 11 a.m. (Dutch time) on May 15, 2007, with an audio-visual link to a satellite meeting place at Novotel London-West Hotel and Convention Centre, Hammersmith, London, UK at 10 a.m. (UK time).

CLASS A AND CLASS B SHARES

Royal Dutch Shell has two classes of shares – Class A shares and Class B shares. The Class A shares and Class B shares have identical rights except in relation to the dividend source. Dividends having a Dutch source are intended to be paid to holders of Class A shares and dividends having a UK source are intended to be paid to holders of Class B shares.

ROYAL DUTCH SHELL LISTING INFORMATION

	Class A shares	Class B shares
Ticker symbol – London	RDSA	RDSB
Ticker symbol – Amsterdam	RDSA	RDSB
Ticker symbol – New York (ADR[A])	RDS.A	RDS.B
ISIN Code	GB00B03MLX29	GB00B03MM408
CUSIP	G7690A100	G7690A118
SEDOL Number – London	B03MLX2	B03MM40
SEDOL Number – Euronext	B09CBL4	B09CBN6
Weighting on FTSE as at 29/12/06	4.396%	3.269%
Weighting on AEX as at 29/12/06	14.62%	not included

[A] One ADR is equal to two underlying shares.

SHARE PRICES

RDSA and Royal Dutch ordinary shares – Amsterdam[A]

€	RDSA		Royal Dutch ordinary shares			
	2006	2005 (Jul 20 to Dec 31)	2005[B] (Jan 1 to Sep 30)	2004	2003	2002
High	28.53	27.67	28.38	22.02	22.29	31.60
Low	24.92	24.12	20.92	18.30	16.68	19.61
Year end	26.72	25.78	25.80	21.18	20.90	20.98

RDSA – London

pence	2006	2005 (Jul 20 to Dec 31)	2004	2003	2002
High	1,880	1,894	–	–	–
Low	1,671	1,633	–	–	–
Year end	1,785	1,771	–	–	–

RDS Class A ADRs and Royal Dutch New York Shares – New York[C]

$	RDS Class A ADRs		Royal Dutch ordinary shares			
	2006	2005 (Jul 20 to Dec 31)	2005[D] (Jan 1 to Sep 30)	2004	2003	2002
High	72.38	68.08	67.45	57.79	52.70	57.30
Low	60.58	57.79	55.37	45.79	36.69	38.60
Year end	70.79	61.49	62.80	57.38	52.39	44.02

RDSB – Amsterdam

€	2006	2005 (Jul 20 to Dec 31)	2004	2003	2002
High	29.60	28.90	–	–	–
Low	25.51	25.41	–	–	–
Year end	26.66	27.08	–	–	–

RDSB and Shell Transport Ordinary Shares – London[E]

pence	RDSB		Shell Transport Ordinary Shares			
	2006	2005 (Jul 20 to Dec 31)	2005 (Jan 1 to Jul 19)	2004	2003	2002
High	2,071	1,968	1,991	1,570	1,531	1,888
Low	1,764	1,717	1,528	1,205	1,154	1,256
Year end	1,790	1,858	1,838	1,545	1,446	1,423

RDS Class B ADRs and Shell Transport ADRs – New York[F]

$	RDS Class B ADRs		Shell Transport ADRs			
	2006	2005 (Jul 20 to Dec 31)	2005 (Jan 1 to Jul 19)	2004	2003	2002
High	74.93	70.94	69.86	59.98	52.42	54.91
Low	63.29	60.69	57.75	45.38	37.45	39.47
Year end	71.15	64.53	64.56	59.63	52.24	45.15

[A] Pursuant to the terms of the Unification, holders of Royal Dutch ordinary shares received two Royal Dutch Shell plc Class A ordinary shares for each Royal Dutch ordinary share. To assist comparison, the historical prices of the Royal Dutch ordinary shares have been divided by 2 to reflect such exchange ratio.

[B] Royal Dutch ordinary shares continued to trade on Euronext Amsterdam following the completion of the Unification until such shares were delisted on September 30, 2005.

[C] Pursuant to the terms of the Unification, holders of Royal Dutch New York Shares received one Royal Dutch Shell plc Class A ADR for each Royal Dutch New York Share. Each Royal Dutch Shell plc Class A ADR represents two Royal Dutch Shell plc Class A ordinary shares.

[D] The New York Stock Exchange halted trading in the Royal Dutch New York Shares on October 3, 2005, following delisting in Amsterdam, and resumed trading in the Royal Dutch New York Shares on October 31, 2005, following the joint public announcement by Royal Dutch Shell and Royal Dutch of the definitive terms of the legal merger between Royal Dutch and its wholly owned subsidiary Shell Petroleum N.V., in which all outstanding Royal Dutch shares were exchanged for €52.21 (or the equivalent in loan notes). The table excludes trading in Royal Dutch New York Shares for the period from October 3, 2005 through their delisting on November 21, 2005.

[E] Pursuant to the terms of the Unification, holders of Shell Transport Ordinary Shares (including Shell Transport Ordinary Shares to which holders of Shell Transport bearer warrants were entitled) received 0.287333066 Royal Dutch Shell plc Class B ordinary shares for each Shell Transport Ordinary Share. To assist comparison, the historical prices of the Shell Transport Ordinary Shares have been divided by 0.287333066 to reflect such exchange ratio.

[F] Pursuant to the terms of the Unification, holders of Shell Transport ADRs received 0.861999198 Royal Dutch Shell plc Class B ADRs for each Shell Transport ADR. To assist comparison, the historical prices of the Shell Transport ADRs have been divided by 0.861999198 to reflect such exchange ratio. Each Royal Dutch Shell plc Class B ADR represents two Royal Dutch Shell plc Class B ordinary shares.

CAPITAL GAINS TAX

For the purposes of UK capital gains tax, the market values of the Company's shares were:

Historical information relating to:	March 31, 1982 £	July 20, 2005 £
Royal Dutch Petroleum Company (N.V. Koninklijke Nederlandsche Petroleum Maatschappij) which ceased to exist on December 21, 2005.	1.1349	17.6625
The "Shell" Transport and Trading Company, p.l.c. which delisted on July 19, 2005.	1.4502	Not applicable

Share prices have been restated where necessary to reflect all capitalisation issues since the relevant date. This includes the change in the capital structure following the Unification Transaction of Royal Dutch and Shell Transport where one Royal Dutch share was exchanged for two Royal Dutch Shell plc Class A ordinary shares and where one Shell Transport share was exchanged for 0.287333066 Royal Dutch Shell plc Class B ordinary shares.

DIVIDENDS

Class A shares (€)	2006	2005	2004
Q1	0.25	0.23[A]	–
Q2	0.25	0.23	–
Q3	0.25	0.23	–
Q4	0.25	0.23	–
Interim	–	–	0.38[A]
Final/second interim	–	–	0.52[A]
Total	1.00	0.92	0.90
Amount paid during the year	0.98	1.21	0.89

Class B shares (pence)	2006	2005	2004
Q1	17.13	15.84[A]	–
Q2	17.08	15.89	–
Q3	16.77	15.64	–
Q4	16.60	15.64	–
Interim	–	–	21.75[A]
Final/second interim	–	–	37.24[A]
Total	67.58	63.01	58.99
Amount paid during the year	66.62	84.61	55.33

Class A ADRs ($)	2006	2005	2004
Q1	0.63	0.59[A]	–
Q2	0.63	0.55	–
Q3	0.63	0.56	–
Q4	0.65	0.56	–
Interim	–	–	0.90[A]
Final/second interim	–	–	1.33[A]
Total	2.54	2.26	2.24
Amount paid during the year	2.45	3.04	2.12

[A] Historical data for Royal Dutch converted to Royal Dutch Shell equivalents.

Class B ADRs ($)	2006	2005	2004
Q1	0.63	0.57[A]	–
Q2	0.63	0.55	–
Q3	0.63	0.56	–
Q4	0.65	0.56	–
Interim	–	–	0.78[A]
Final/second interim	–	–	1.43[A]
Total	2.54	2.24	2.21
Amount paid during the year	2.45	3.10	1.99

Royal Dutch Shell intends to pay quarterly dividends and to grow the dividend at least in line with inflation over a number of years. On February 1, 2007 the Board announced that going forward the inflation level will be based on inflation levels in global developed economies, rather than a blend of European inflation rates. Dividend growth going forward will be measured in US dollars.

On February 1, 2007 the Board also announced that effective from the first quarter 2007, dividends will be declared in dollars rather than euro. The Company will announce the euro and pound sterling equivalent amounts at the same time as the dollar declaration, using an exchange rate from the day before the declaration date.

Dividends declared on A shares are paid by default in euros, although holders of A shares are able to elect to receive dividend in pounds sterling. Dividends declared on B shares are paid by default in pound sterling, although holders of B shares are able to elect to receive dividend in euro. Dividends declared on ADRs are paid in dollars. Eligible shareholders must make currency elections the day before the declaration date.

It is expected that holders of Class B ordinary shares will receive dividends through the dividend access mechanism applicable to such shares.

DIVIDEND REINVESTMENT PLAN (DRIP)

A DRIP is offered on both classes of shares and, depending on how an investor holds shares, is offered by either Lloyds TSB Registrars or ABN Amro. DRIPs for ADRs traded on the NYSE are offered by the Bank of New York.

LLOYDS TSB REGISTRARS

The DRIP operated by Lloyds TSB Registrars is available to investors in respect of shares held directly in the Royal Dutch Shell Nominee Service or on the Royal Dutch Shell plc share register. You will be liable for tax on dividends reinvested on the same basis as if you had received the cash and arranged the purchase of shares yourself.

ABN AMRO

The DRIP operated by ABN Amro is available to shareholders who hold their shares via Euroclear Nederland through an admitted institution of Euroclear Nederland and are expecting to receive the dividend in the default currency for Class A ordinary and Class B ordinary shares.

THE BANK OF NEW YORK

The Bank of New York maintains a (Global BuyDIRECT℠) plan for the Royal Dutch Shell Class A ADRs, available to registered holders and first time investors and a DRIP for the Class B ADRs available to registered ADR holders.

Tax consequences of participation in the plan may vary depending upon the tax residence of the shareholder and the class of shares held. Holders of Class A ordinary shares should note that it is the net dividend that will be reinvested. To participate, or if you have any further questions, please call your bank or broker if your shareholding is through Euroclear Nederland, the Bank of New York if enquiries relate to ADRs and Lloyds TSB Registrar for all other shareholders.

INDEXED SHARE PRICE

— RDSA Amsterdam — AEX Index

Index: December 31, 2001 = 100

— RDSB London — FTSE 100

Index: December 31, 2001 = 100

FINANCIAL CALENDAR

Financial year ends	December 31, 2006

ANNOUNCEMENTS

Full year results for 2006	February 1, 2007
First quarter results for 2007	May 3, 2007
Second quarter results for 2007	July 26, 2007
Third quarter results for 2007	October 25, 2007

DIVIDENDS – ORDINARY SHARES CLASS A AND CLASS B INCLUDING ADRS

2006 Fourth quarter interim [A]

Announced	February 1, 2007
Ex-dividend date	February 7, 2007
Record date	February 9, 2007
Payment date	March 14, 2007

2007 First quarter interim

Announced	May 3, 2007
Ex-dividend date	May 9, 2007
Record date	May 11, 2007
Payment date	June 13, 2007

2007 Second quarter interim

Announced	July 26, 2007
Ex-dividend date	August 1, 2007
Record date	August 3, 2007
Payment date	September 12, 2007

2007 Third quarter interim

Announced	October 25, 2007
Ex-dividend date	October 31, 2007
Record date	November 2, 2007
Payment date	December 12, 2007

ANNUAL GENERAL MEETING	May 15, 2007

[A] The Directors do not propose to recommend any further distribution in respect of 2006.

Contact information

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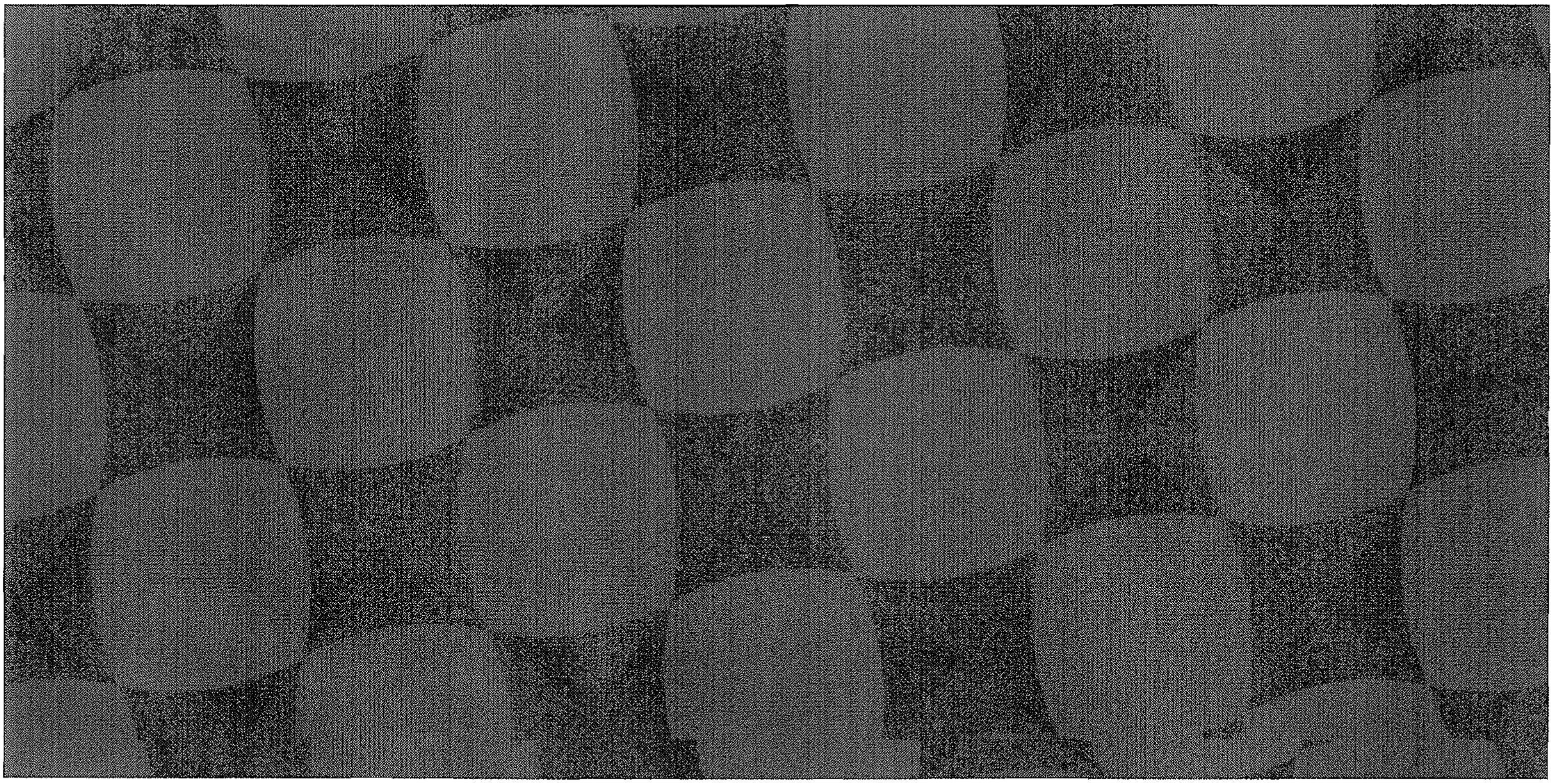


PUBLICATION REQUESTS

Copies of all publications of the Group are available from:

Royal Dutch Shell plc
c/o Bankside
Tel +44 (0)1635 232700
E-mail bbs@shellbankside.co.uk

Annual Report/20-F Service for US residents:
Tel (888) 400 7789

More information about the Group is available at **www.shell.com**

PUBLICATIONS

Annual Report and Form 20-F for the year ended December 31, 2006
A comprehensive overview of the Group.
Available at **www.shell.com/annualreport**

Annual Review and Summary Financial Statements 2006
A summarised overview and the operational and financial performance of the business.
Available at **www.shell.com/annualreport**

Jaaroverzicht en verkorte jaarrekening 2006
Dutch language version.
Available at **www.shell.com/annualreport**

Financial and Operational Information 2002-2006 (available May 2007)
Five years' financial and operational information, including maps of exploration and production activities.
Available at **www.shell.com/faoi**

Shell Sustainability Report 2006 (available May 2007)
Report on progress in contributing to sustainable development.
Available at **www.shell.com/envandsociety**

Shell Technology Report
An overview of 27 advanced technologies.
Available at **www.shell.com/technology**

Shell General Business Principles
Fundamental principles that govern how each Shell company conducts its affairs.
Available at **www.shell.com/sgbp**

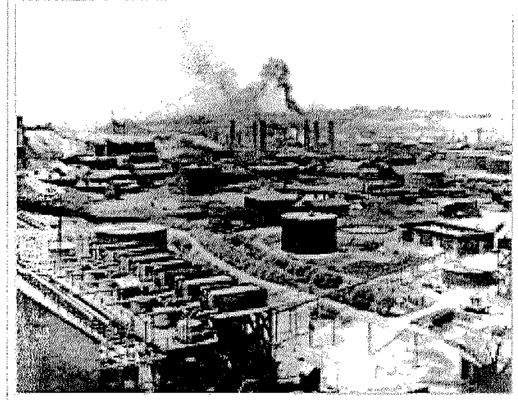
Shell Code of Conduct
Provides standards of behaviour expected from employees.
Available at **www.shell.com/codeofconduct**

Standard Oil

From Wikipedia, the free encyclopedia

Standard Oil (**Esso**) was a predominant integrated oil producing, transporting, refining, and marketing company. Established in 1870 and operating as a major company trust until it was dissolved by the US Supreme Court in 1911, it was one of the world's first and largest multinational corporations.[1]

Contents



Standard Oil Refinery No. 1 in Cleveland, Ohio, 1899

Early years

Standard Oil began as an Ohio partnership formed by the well-known industrialist John D. Rockefeller, his brother William Rockefeller, Henry Flagler, chemist Samuel Andrews, and a silent partner Stephen V. Harkness. Using highly effective and (later) widely criticized tactics, the company absorbed or destroyed most of its competition in Cleveland, Ohio; and later throughout the northeastern United States, putting numerous small corporations out of business.

In the early years, John Rockefeller dominated the combine, for he was the single most important figure in shaping the new oil industry.[1] He quickly distributed power and the tasks of policy formation to a system of committees, although always retaining the largest shareholding in the company. Authority was centralized in the company's main office in Cleveland, yet within that office decisions were arrived at in a cooperative manner.[2] In response to state laws attempting to limit the scale of companies, Rockefeller and his partners had to develop innovative ways of organizing so that they could effectively manage their rapidly expanding enterprise. In 1882, they combined their disparate companies, spread across dozens of states, under a single group of trustees. This organization proved so successful that other giant enterprises adopted this "trust" form. At the same time, state and federal laws sought to counter this development with "antitrust" laws.

The state of Ohio successfully sued Standard Oil, compelling the dissolution of the trust in 1892. Standard Oil fought this decree, in essence separating off only Standard Oil of Ohio without relinquishing control of that company. Eventually, the state of New Jersey changed its incorporation laws to allow a single company to hold shares in other companies in any other state. Hence, in 1899, the Standard Oil Trust, based at 26 Broadway in New

York, was legally reborn as a holding company - a corporation known as the *Standard Oil Company of New Jersey* (SONJ), which held stock in forty-one other companies, which controlled other companies, which in turn controlled yet other companies, in a conglomerate that was seen by the public as all-pervasive, controlled by a select group of directors, and completely unaccountable.[3]

Thus, in due course, the U.S. Justice Department sued Standard Oil of New Jersey under the federal anti-trust law, the Sherman Antitrust Act of 1890. In 1911, the Supreme Court upheld the lower court judgment, and forced Standard Oil to separate into thirty-four companies, each with its own distinct board of directors. Standard's president, John D. Rockefeller had, by then, long since retired from any management role, but, as he owned a quarter of all the outstanding shares of the many resultant companies, whose post-dissolution share value mostly doubled, he emerged from the dissolution even more wealthy; the richest man in America, and thus the world.[4]

The off-shoot companies form the core of today's U.S. oil industry, including ExxonMobil (formerly Standard of New Jersey and Standard of New York), ConocoPhillips (the Conoco side, which was Standard's company in the Rocky Mountain states), Chevron (Standard of California), Amoco and Sohio (Standard of Indiana and Standard of Ohio, respectively, now BP of North America), Atlantic Richfield (the Atlantic side, now also a part of BP North America), Marathon (covering western Ohio and other parts of Ohio not covered by Sohio) and many other smaller companies.

Business strategy of Standard Oil

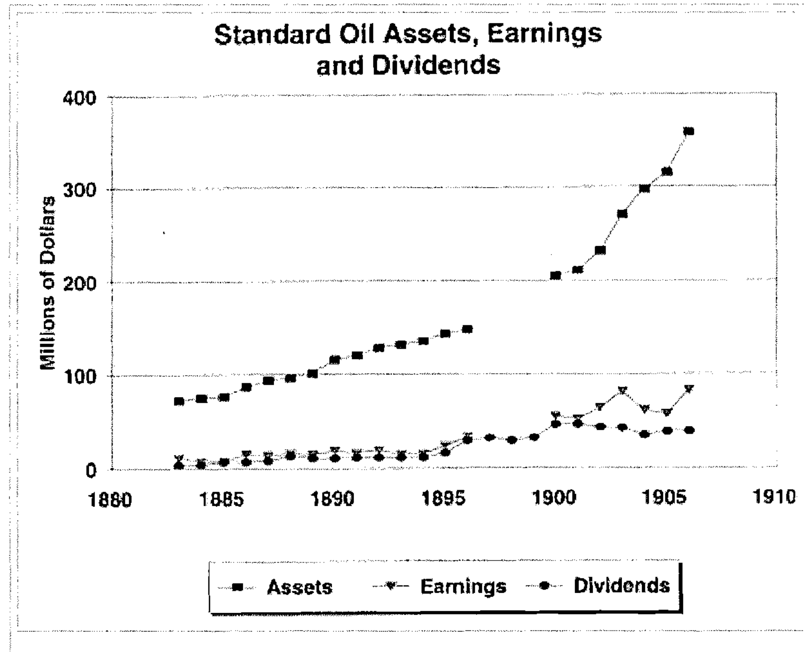
Standard Oil's market position had been established through an emphasis on efficiency and responsibility. While most companies dumped gasoline (this being before the automobile) in rivers, Standard used it to fuel the company's own machines. Where gigantic mountains of heavy waste grew by other companies' refineries, Rockefeller found ways to market and sell these waste products, creating the first synthetic competitor for beeswax, as well as acquiring the company that invented and produced Vaseline, the Chesebrough Manufacturing Company, which was a Standard company only from 1908 until 1911.

As the company grew larger through more effective business practices, it developed other strongly competitive strategies, including a systematic program of offering to purchase competitors. After purchasing them, Rockefeller shut down the ones he believed to be inefficient while keeping the others. In a seminal deal, in 1868, the Lake Shore Railroad, a part of the New York Central, gave Rockefeller's firm a $0.25 cents/bbl. (71%) discount off of its listed rates in return for a promise to ship at least 60 carloads of oil daily and to handle the loading and unloading on its own, a huge competitive advantage.

Smaller companies decried the deals as being unfair because they were not producing enough oil to qualify for discounts. In 1872, Rockefeller joined the South Improvement Company which would have allowed him to receive rebates for shipping oil but also to receive drawbacks on oil his competitors shipped. When word got out of this arrangement, competitors convinced the Pennsylvania Legislature to revoke South Improvement's charter. No oil was ever shipped under this arrangement.

In one example of Standard's aggressive practices, a rival oil association decided to build an oil pipeline, hoping to overcome the virtual boycott imposed on Standard's competitors. In response, the railroad company (at Rockefeller's direction) denied the consortium permission to run the pipeline across railway land, forcing consortium staff to laboriously decant the oil into barrels, carry them over the railway crossing in carts, and then pump the oil manually back into the pipeline on the other side. When he learned of this tactic, Rockefeller then instructed the railway company to park empty rail cars across the line, thereby preventing the carts from crossing his property.

Standard's actions and secret transport deals helped its kerosene to drop in price from 58 to 26 cents between 1865 and 1870. Competitors might not have appreciated the company's business practices, but consumers appreciated the drop in prices. Standard Oil, being formed well before the discovery of the Spindletop oil field and a demand for oil other than for heat and light, was well placed to control the growth of the oil business. The company was perceived to own and control all aspects of the trade. Oil could not leave the oil field unless Standard Oil agreed to move it: the "posted price" for oil was the price that Standard Oil agents printed on flyers that were nailed to posts in oil producing areas, and producers were in a take-it-or-leave-it position.



In 1890, Standard Oil of Ohio moved its headquarters out of Cleveland and into its permanent headquarters at 26 Broadway in New York City. Concurrently, the trustees of Standard Oil of Ohio chartered the Standard Oil Company of New Jersey in order to take advantages of New Jersey's more lenient corporate stock ownership laws. Standard Oil of New Jersey eventually became one of many important companies that dominated key markets, such as steel and the railroads.

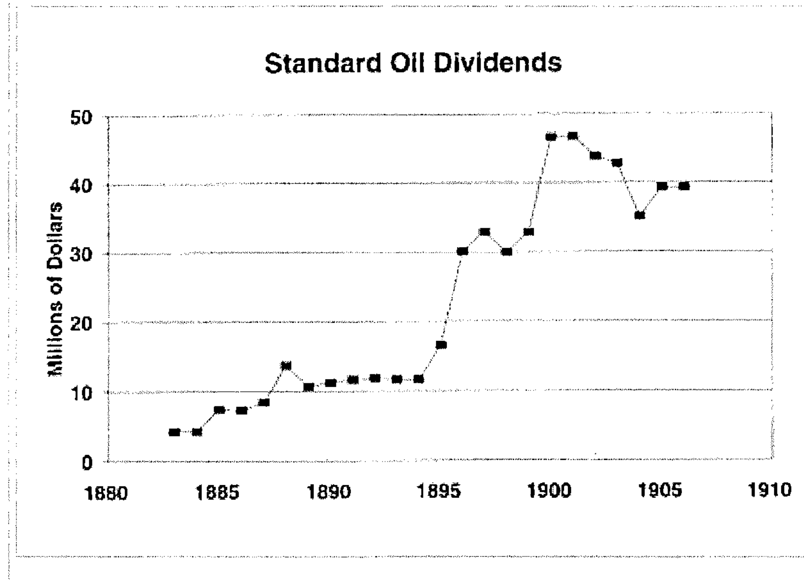
Also in 1890, Congress passed the Sherman Antitrust Act -- the source of all American anti-monopoly laws. The law forbade every contract, scheme, deal, or conspiracy to restrain trade, though the phrase "restraint of trade" remained subjective. The Standard Oil group quickly attracted attention from antitrust authorities leading to a lawsuit filed by then Ohio Attorney General David K. Watson.

Then came Ida M. Tarbell, an American author and journalist, and one of the original "muckrakers". Her father was an oil producer whose business had failed due to Rockefeller's business dealings. Following extensive interviews with a sympathetic senior executive of Standard Oil, Henry H. Rogers, Tarbell's investigations of Standard Oil fueled growing public attacks on Standard Oil and on monopolies in general. Her work was first published in nineteen parts in *McClure's* magazine, from November 1902 to October 1904, in which year it was published in book form as *The History of the Standard Oil Company*.

Standard paid out in dividends during 1882 to 1906 in the amount of $548,436,000, at 65.4% payout ratio. A large part of the profits was not distributed to stockholders, but was put back into the business. The total net earnings from 1882-1906 amounted to $838,783,800, exceeding the dividends by $290,347,800. The latter amount was used for plant expansion.

The Standard Oil Trust itself was controlled by a small group of families. Rockefeller himself stated in 1910: "I think it is true that the Pratt family, the Payne-Whitney family (which were one, as all the stock came from Colonel Payne), the Harkness-Flagler family (which came into the Company together) and the Rockefeller family controlled a majority of the stock during all the history of the Company up to the present time".[5]

These families reinvested most of the dividends in other industries, especially railroads. They also invested heavily in the gas and the electric lighting business (including the giant Consolidated Gas Company of New York City). They made large purchases of stock in U.S. Steel, Amalgamated Copper, and even Corn Products Refining Company.[6]



Monopoly charges, anti-trust litigation, and breakup of the Standard Oil group

By 1890, Standard Oil controlled 88% of the refined oil flows in the United States. In 1904 when the lawsuit began it controlled 91% of production and 85% of final sales. Most of its output was kerosene, of which 55% was exported around the world. In terms of cost efficiency, Standard's plants were about the same as competitors. After 1900 it did not try to force competitors out of business by underpricing them. [7] Beyond question, the federal Commissioner of Corporations concluded, the dominant position in the refining industry was due "to unfair practices-to abuse of the control of pipe-lines, to railroad discriminations, and to unfair methods of competition."[8] Gradually, its market share fell to 64% by 1911. Standard did not try to monopolize the exploration and pumping of oil (its share in 1911 was 11%). John D. Rockefeller in 1897 had completely retired from the Standard Oil Company of New Jersey, though he continued to own a large fraction of its shares. Vice-president John D. Archbold then took a large part in the running of the firm.

In 1909, the U.S. Department of Justice filed suit in federal court alleging that Standard had engaged in the following methods to continue the monopoly and restrain interstate commerce: [9]

> "Rebates, preferences, and other discriminatory practices in favor of the combination by railroad companies; restraint and monopolization by control of pipe lines, and unfair practices against competing pipe lines; contracts with competitors in restraint of trade; unfair methods of competition, such as local price cutting at the points where necessary to suppress competition; [and] espionage of the business of competitors, the operation of bogus independent companies, and payment of rebates on oil, with the like intent."

The lawsuit further argued that Standard's monopolistic practices took place in the last four years: [10]

> "The general result of the investigation has been to disclose the existence of numerous and flagrant discriminations by the railroads in behalf of the Standard Oil Company and its affiliated corporations. With comparatively few exceptions, mainly of other large concerns in California, the Standard has been the sole beneficiary of such discriminations. In almost every section of the country that company has been found to enjoy some unfair advantages over its competitors, and some of these discriminations affect enormous areas."

The government identified four illegal patterns: 1) secret and semi-secret railroad rates; (2) discriminations in the open arrangement of rates; (3) discriminations in classification and rules of shipment; (4) discriminations in the treatment of private tank cars. The government alleged:[11]

> "Almost everywhere the rates from the shipping points used exclusively, or almost exclusively, by the Standard are relatively lower than the rates from the shipping points of its competitors. Rates have been made low to let the Standard into markets, or they have been made high to keep its competitors out of markets. Trifling differences in distances are made an excuse for large differences in rates favorable to the Standard Oil Company, while large differences in distances are ignored where they are against the Standard. Sometimes connecting roads prorate on oil--that is, make through rates which are lower than the combination of local rates; sometimes they refuse to prorate; but in either case the result of their policy is to favor the Standard Oil Company. Different methods are used in different places and under different conditions, but the net result is that from Maine to California the general arrangement of open rates on petroleum oil is such as to give the Standard an unreasonable advantage over its competitors

The government said that Standard raised prices to its monopolistic customers, but lowered them to hurt competitors, often disguising its illegal actions by using bogus supposedly "independent" companies it controlled. [12]

> "The evidence is, in fact, absolutely conclusive that the Standard Oil Company charges altogether excessive prices where it meets no competition, and particularly where there is little likelihood of competitors entering the field, and that, on the other hand, where competition is active, it frequently cuts prices to a point which leaves even the Standard little or no profit, and which more often leaves no profit to the competitor, whose costs are ordinarily somewhat higher."

On May 15, 1911, the United States Supreme Court ordered the breakup of the Standard Oil group of companies into thirty-four independent companies, each with its own board of directors.[13] The Court declared the group to be an "unreasonable" monopoly under the Sherman Antitrust Act.

Legacy

Whether the existence of Standard Oil was beneficial is a matter of some controversy.[14] The notion that Standard was a monopoly is rejected by some economists, citing its much reduced market presence by the time of the antitrust trial. In 1890, Rep. William Mason, arguing in favor of the Sherman Antitrust Act, said: "trusts have made products cheaper, have reduced prices; but if the price of oil, for instance, were reduced to one cent a barrel, it would not right the wrong done to people of this country by the *trusts* which have destroyed legitimate competition and driven honest men from legitimate business enterprise".[15]

The Sherman Act prohibits the restraint of trade. Defenders of Standard Oil insist that the company did not restrain trade, they were simply superior competitors. The federal courts ruled otherwise.

Many analysts agree that the breakup was beneficial to consumers in the long run, and no one has ever proposed that Standard Oil be reassembled in pre-1911 form.[16]

Successor companies

Successor companies to the **Standard Oil Trust** (post-1911) include:

- Standard Oil of New Jersey (SONJ) - or Esso (S.O. or Eastern States, Standard Oil) - renamed Exxon, now part of ExxonMobil. Standard Trust companies Carter Oil, Imperial Oil (Canada), and Standard of Louisiana were kept as part of Standard Oil of New Jersey after the breakup.
- Standard Oil of New York - or Socony, merged with Vacuum - renamed Mobil, now part of ExxonMobil.
- Standard Oil of California - or Socal - renamed Chevron, became ChevronTexaco, but returned to Chevron.
- Standard Oil of Indiana - or Stanolind, renamed Amoco (American Oil Co.) - now part of BP.
- Standard's Atlantic and the independent company Richfield merged to form Atlantic Richfield or Arco, now part of BP. Atlantic operations were spun off and bought by Sunoco.
- Standard Oil of Kentucky - or Kyso was acquired by Standard Oil of California - currently Chevron.
- Continental Oil Company - or Conoco now part of ConocoPhillips.
- Standard Oil of Ohio - or Sohio now part of BP.
- The Ohio Oil Company - more commonly referred to as "The Ohio", and marketed gasoline under the Marathon name. The company is now known as Marathon Oil Company, and was often a rival with the in-state Standard spinoff, Sohio.

See also Seven Sisters (oil companies)

Other Standard Oil spin-offs:

- Standard Oil of Iowa - pre-1911 - became Standard Oil of California.
- Standard Oil of Minnesota - pre-1911 - bought by Standard Oil of Indiana.
- Standard Oil of Illinois - pre-1911 - bought by Standard Oil of Indiana.
- Standard Oil of Kansas - refining only, eventually bought by Indiana Standard.
- Standard Oil of Missouri - pre-1911 - dissolved.
- Standard Oil of Louisiana - always owned by Standard Oil of New Jersey (now Exxon).
- Standard Oil of Brazil - always owned by Standard Oil of New Jersey (now Exxon).
- Standard Oil of Colorado - a scam to cash in on the Standard Oil brand in the 1930s.
- Standard Oil of Connecticut - A fuel oil marketer in Connecticut not related to the Rockefeller companies.

Other companies divested in the 1911 breakup:

- Anglo-American Oil Co. - acquired by Jersey Standard in 1930, now Esso UK.
- Buckeye Pipeline Co.
- Borne-Scrymser Co. (chemicals)
- Chesebrough Manufacturing (Vasoline)
- Colonial Oil.
- Crescent Pipeline Co.
- Cumberland Pipe Line Co.
- Eureka Pipe Line Co.

- Galena-Signal Oil Co.
- Indiana Pipe Line Co.
- National Transit Co.
- New York Transit Co.
- Northern Pipe Line Co.
- Prairie Oil & Gas.
- Solar Refining.
- Southern Pipe Line Co.
- South Penn Oil Co. - eventually became Pennzoil, now part of Shell.
- Southwest Pennsylvania Pipe Line Co.
- Swan and Finch.
- Union Tank Lines.
- Washington Oil Co.
- Waters-Pierce.

Notes

1. ^ [a] [b] One of the world's first and biggest multinationals - see Daniel Yergin, *The Prize: The Epic Quest for Oil, Money, and Power*. New York: Simon & Schuster, 1991, (p.35).
2. ^ Hidy, Ralph W. and Muriel E. Hidy. *Pioneering in Big Business, 1882-1911: History of Standard Oil Company (New Jersey)* (1955).
3. ^ Standard Oil of New Jersey seen as all-pervasive and unaccountable, holding stock in a myriad of other companies - see Yergin, op. cit., (pp.96-98)
4. ^ Rockefeller the richest man after the dissolution of 1911 - see Yergin, op. cit., (p.113)
5. ^ Standard Oil controlled by a small group of families - see Ron Chernow, *Titan: The Life of John D. Rockefeller, Sr.*, London: Warner Books, 1998, (p.291)
6. ^ Jones, Eliot. *The Trust Problem in the United States* pp. 89-90 (1922) (hereinafter *Jones*).
7. ^ Jones pp 58-59, 64.
8. ^ Jones. pp. 65-66.
9. ^ Manns, Leslie D., "Dominance in the Oil Industry: Standard Oil from 1865 to 1911" in David I. Rosenbaum ed., *Market Dominance: How Firms Gain, Hold, or Lose it and the Impact on Economic Performance*, p. 11 (Praeger 1998).
10. ^ Jones, p. 73.
11. ^ Jones, p 75-76.
12. ^ Jones, p. 80.
13. ^ See generally *Standard Oil Co. of New Jersey v. United States*, 221 U.S. 1 (1911).
14. ^ see [1] [2]
15. ^ Congressional Record, 51st Congress, 1st session, House, June 20, 1890, p. 4100.
16. ^ David I. Rosenbaum, *Market Dominance: How Firms Gain, Hold, or Lose it and the Impact on Economic Performance*, New York: Praeger Publishers, 1998, (pp.31-33)

See also

- John D. Rockefeller
- William Rockefeller

- Rockefeller family
- Exxon Mobil
- John D. Archbold
- Henry H. Rogers
- Charles Pratt
- Charles Pratt and Company
- Henry Flagler
- Ida M. Tarbell
- Anti-trust
- Monopoly
- Wamsutta Oil Refinery
- Standard Oil Gasoline Station
- Standard Oil Co. of New Jersey v. United States
- History of the United States (1865-1918)

Bibliography

- Bringhurst, Bruce. *Antitrust and the Oil Monopoly: The Standard Oil Cases, 1890-1911*. New York: Greenwood Press, 1979.
- Chernow, Ron. *Titan: The Life of John D. Rockefeller, Sr.* London: Warner Books, 1998.
- Droz, R.V. Whatever Happened to Standard Oil?, 2004. Retrieved June 25, 2005.
- Folsom, Jr., Burton W. *John D. Rockefeller and the Oil Industry* from *The Myth of the Robber Barons*. New York: Young America, 2003.
- Giddens, Paul H. *Standard Oil Company (Companies and men)*. New York: Ayer Co. Publishing, 1976.
- Henderson, Wayne. *Standard Oil: The First 125 Years*. New York: Motorbooks International, 1996.
- Hidy, Ralph W. and Muriel E. Hidy. *History of Standard Oil Company (New Jersey : Pioneering in Big Business 1882-1911)*. New York: Ayer Co. Publishing, 1987.
- Jones; Eliot. *The Trust Problem in the United States* 1922. Chapter 5; online edition
- Klein, Henry H. *Dynastic America and Those Who Own It*. New York: Kessinger Publishing, [1921] Reprint, 2003.
- Knowlton, Evelyn H. and George S. Gibb. *History of Standard Oil Company: Resurgent Years 1911-1927*. New York: Harper & Row, 1956.
- Larson, Henrietta M., Evelyn H. Knowlton and Charles S. Popple. *New Horizons 1927 - 1950 (History of Standard Oil Company (New Jersey), Volume 3)*. New York: Harper & Row, 1971.
- Latham, Earl ed. *John D. Rockefeller: Robber Baron or Industrial Statesman?*, 1949. Primary and secondary sources.
- Manns, Leslie D. "Dominance in the Oil Industry: Standard Oil from 1865 to 1911" in David I. Rosenbaum ed, *Market Dominance: How Firms Gain, Hold, or Lose it and the Impact on Economic Performance*. Praeger, 1998. online edition
- Montague, Gilbert Holland. *The Rise And Progress of the Standard Oil Company*. New York: Kessinger Publishing, [1902] Reprint, 2005.
- Nevins, Allan. *John D. Rockefeller: The Heroic Age of American Enterprise*. 2 vols. New York: Charles Scribner's Sons, 1940.
- Nevins, Allan. *Study In Power: John D. Rockefeller, Industrialist and Philanthropist*. 2 vols. New York: Charles Scribner's Sons, 1953.
- Nowell, Gregory P. (1994). *Mercantile States and the World Oil Cartel, 1900-1939.*. Cornell University Press.
- Standard Oil Company of California. Whatever happened to Standard Oil?, 1980. Retrieved June 25, 2005.
- Tarbell, Ida M. *The History of the Standard Oil Company*, 1904. The famous original expose in *McClure's Magazine* of Standard Oil.
- Wall, Bennett H. *Growth in a Changing Environment: A History of Standard Oil Company (New Jersey), Exxon Corporation, 1950-1975*. New

York: Harpercollins, 1989.
- Williamson, Harold F. and Arnold R. Daum. *The American Petroleum Industry: The Age of Illumination, 1859-1899*, 1959: vol 2, *American Petroleum Industry: the Age of Energy 1899-1959*, 1964. The standard history of the oil industry. online edition of vol 1
- Yergin, Daniel. *The Prize: The Epic Quest for Oil, Money, and Power*. New York: Simon & Schuster, 1991.

External links

- The Dismantling of The Standard Oil Trust
- Educate Yourself- Standard Oil -- Part I
- Witch-hunting for Robber Barons: The Standard Oil Story by Lawrence W. Reed - Argues Standard Oil was not a coercive monopoly.
- Google Books: Dynastic America and Those Who Own It, 2003 {1921}, by Henry H. Klein
- David K. Watson
- Standard Oil Trust original Stock Certificate signed by John. D. Rockefeller, William Rockefeller, Henry M. Flagler and Jabez Abel Bostwick - 1882
- Whatever happened to Standard Oil?: Pre-1911 and Post-1911 - Timeline of the various subsidiaries
- Standard Oil around the World: Post-1911

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Categories: Standard Oil | Rockefeller family | History of the petroleum industry | Monopolies | Companies established in 1870 | Defunct American oil companies | 1911 disestablishments

ExxonMobil

From Wikipedia, the free encyclopedia

Exxon Mobil Corporation or **ExxonMobil** (NYSE: XOM), headquartered in Irving, Texas, a suburb of Dallas, USA, is the largest publicly traded integrated oil and gas company in the world, formed on November 30, 1999, by the merger of Exxon and Mobil. As of 2007 it is the largest company in the world (in market value) as ranked by the Forbes Global 2000; at $410.7 billion and the second largest company in the world (by revenue), after Wal-Mart Stores as ranked by the Fortune Global 500. It is the largest of the six oil "supermajors" with daily production of 6.5m boe (barrels of oil equivalent), contributing 3% of the world's oil and 2% of the world's energy.

As of 2007, Exxonmobil Corporation ranks as the seventh largest company in the world overall, according to the Forbes Global 2000.

Exxon Mobil Corporation	
Type	Public (NYSE: XOM)
Founded	1999 (merger) 1911 (Standard Oil of New Jersey) 1911 (Standard Oil of New York) 1870 (Standard Oil)
Headquarters	Irving, Texas, USA
Key people	Rex W. Tillerson (Chairman/CEO)
Industry	Oil and Gas
Products	Fuels, Lubricants, Petrochemicals
Revenue	▲ $377.635 Billion USD (2006)
Net income	▲ $39.50 Billion USD (2006) 10.46% profit margin
Employees	106,100 Including Company Operated Retail Sites ("CORS")[1]
Slogan	"Taking on the world's toughest energy challenges", "We're drivers too", "Understanding Energy"
Website	www.exxonmobil.com

Contents

Corporate divisions

Exxon Mobil Global Corporate Headquarters are located in Irving, a suburb of Dallas, Texas, whereby this company markets products around the world under the brands of Exxon, Mobil, and Esso; it also owns hundreds of smaller subsidiaries such as Imperial Oil Limited (66% ownership) (an oil retailer in Canada) and SeaRiver Maritime.

The company is bifurcated into a "Downstream" division (marketing, refining, and retail operations) located in Fairfax, Virginia, an "Upstream" division (oil exploration, extraction, shipping, and wholesale operations) located in Houston, Texas, and a "Chemicals" division also located in Houston, Texas. Although most internal operations are divided along these lines, the company also has several ancillary divisions, such as Coal & Minerals, which are standalone and not part of either the Upstream or the Downstream segments.

The upstream division dominates the company's cashflow, accounting for approximately 70% of revenue. The company employs over 100,000 people worldwide, with approximately 4,000 employees in its Fairfax downstream headquarters and 27,000 people in its Houston upstream headquarters.

The merger of Exxon and Mobil was unique in American history because it reunited the two largest companies of John D. Rockefeller's Standard Oil trust, Standard Oil Company of New Jersey/Exxon and Standard Oil Company of New York/Mobil, which had been forcibly separated by government order nearly a century earlier.

In 2005, ExxonMobil replaced Wal-Mart as the world's largest publicly held corporation when measured by revenue, although Wal-Mart remains the largest by number of employees.

In 2006, Wal-Mart recaptured the lead with revenues of $348.7 billion against ExxonMobil's $335.1. ExxonMobil continues to lead the world in both profits ($39.5 billion in 2006), and market value ($410.7 billion).

History

Both Exxon and Mobil were descendants of the John D. Rockefeller corporation, Standard Oil. The reputation of Standard Oil in the public eye suffered badly after publication of Ida M. Tarbell's classic exposé *The History of the Standard Oil Company* in 1904, leading to a growing outcry for the government to take action against the company.

By 1911, with public outcry at a climax, the Supreme Court of the United States ruled that Standard Oil must be dissolved and split into 34 companies. Two of these companies were Jersey Standard ("Standard Oil Company of New Jersey"), which eventually became Exxon, and Socony ("Standard Oil Company of New York"), which eventually became Mobil.

In the same year, the nation's kerosene output was eclipsed for the first time by gasoline. The growing automotive market inspired the product trademark Mobiloil, registered by Socony in 1920.

Over the next few decades, both companies grew significantly. Jersey Standard, led by Walter C. Teagle, became the largest oil producer in the world. It acquired a 50 percent share in Humble Oil & Refining Co., a Texas oil producer. Socony purchased a 45 percent interest in Magnolia Petroleum Co., a major refiner, marketer and pipeline transporter. In 1931, Socony merged with Vacuum Oil Co., an industry pioneer dating back to 1866 and a growing Standard Oil spin-off in its own right.

In the Asia-Pacific region, Jersey Standard had oil production and refineries in Indonesia but no marketing network. Socony-Vacuum had Asian marketing outlets supplied remotely from California. In 1933, Jersey Standard and Socony-Vacuum merged their interests in the region into a 50-50 joint venture. Standard-Vacuum Oil Co., or "Stanvac," operated in 50 countries, from East Africa to New Zealand, before it was dissolved in 1962.

Mobil Chemical Company was established in 1960. As of 1999 its principal products included basic olefins and aromatics, ethylene glycol and polyethylene. The company produced synthetic lubricant base stocks as well as lubricant additives, propylene packaging films and catalysts. Exxon Chemical Company (first named Enjay Chemicals) became a worldwide organization in 1965 and in 1999 was a major producer and marketer of olefins, aromatics, polyethylene and polypropylene along with specialty lines such as elastomers, plasticizers, solvents, process fluids, oxo alcohols and adhesive resins. The company was an industry leader in metallocene catalyst technology to make unique polymers with improved performance.

In 1955, Socony-Vacuum became Socony Mobil Oil Co. and in 1966 simply Mobil Oil Corp. A decade later, the newly incorporated Mobil Corporation absorbed Mobil Oil as a wholly owned subsidiary. Jersey Standard changed its name to Exxon Corporation in 1972 and established Exxon as a trademark throughout the United States. In other parts of the world, Exxon and its affiliated companies continued to use its Esso trademark.

On March 24, 1989, shortly after midnight, the Exxon Valdez oil tanker struck Bligh Reef in Prince William Sound, Alaska, spilling more than 11 million gallons (42,000 m^3) of crude oil. The spill was the second largest in U.S. history, and in the aftermath of the Exxon Valdez incident, the U.S. Congress passed the Oil Pollution Act of 1990. Immediately after the spill, Exxon voluntarily paid $300 million to over 11,000 Alaskans and businesses affected by the Valdez spill. In addition, the company paid $2.2 billion to clean up Prince William Sound, a process that lasted until 1992, when the State of Alaska and the U.S. Coast Guard declared the clean-up complete. Exxon paid $1 billion in settlements with the state and federal governments. Virtually all Valdez compensatory damages were paid in full within one year of the accident, and the trial court commended Exxon for coming forward "with its people and its pocketbook and doing what had to be done under difficult circumstances." However, a $4.5 billion punitive ruling against Exxon is still under appeal. The punitive damages were set by a federal court judge in Anchorage, and have twice been vacated by the Ninth Circuit Court of Appeals as excessive.

In 1998, Exxon and Mobil signed a US$73.7 billion definitive agreement to merge and form a new company called Exxon Mobil Corporation, the largest company on the planet. After shareholder and regulatory approvals, the merger was completed on November 30, 1999.

In 2000, ExxonMobil sold a refinery in Benicia, California and 340 Exxon-branded stations to Valero Energy Corporation, as part of an FTC-mandated divestiture of California assets. ExxonMobil continues to supply petroleum products to over 700 Mobil-branded retail outlets in California.

In 2005, ExxonMobil's stock price surged in parallel with rising oil prices, surpassing General Electric as the largest corporation in the world in terms of market capitalization. At the end of 2005, it reported record profits of US $36 billion in annual income, up 42% from the previous year (the overall annual income was an all-time record for annual income by any business, and included $10 billion in the third quarter alone, also an all-time record income for a single quarter by any business). The company and the American Petroleum Institute, the Oil and Chemical industry's lobbying apparatus, tried to downplay its success in order to avoid consumer criticism by putting up page-long ads in major American newspapers, such as *The New York Times*, *The Washington Post*, comparing oil industry profits to those of other large industries such as pharmaceuticals and banking. [11] [12] As an illustration, ExxonMobil's $36 billion in profits came on top of $370.6 billion in revenue, with a profit margin of 9.7%. In other words, Exxon netted 9.7 cents on each dollar of revenue it brought in. By contrast, Microsoft earned 30.8 cents for each dollar of revenue, and Google earned 23.9 cents for each dollar of revenue. Starbucks' profit margin was slightly lower than ExxonMobil's, at 7.8 cents for each dollar of revenue.

Exxon's long-time mascot is a tiger; Mobil's mascot is a red pegasus which dates back to the late 19th century and is one of the oldest marketing symbols still in use.

Corporate governance

The current Chairman of the Board and CEO of Exxon Mobil Corporation is Rex Tillerson. Tillerson assumed the top position on January 1, 2006, on the retirement of long-time chairman and CEO, Lee Raymond, who received a highly controversial retirement and severance package of approximately $400 Million.

Board of directors

Current Exxon Mobil board members are (January 29, 2007) :[13]

- Michael Boskin, professor of economics, Stanford University
- William W. George, professor of management practice, Harvard Business School
- James R. Houghton, Chairman of the Board, Corning Incorporated
- William R. Howell, Chairman Emeritus, J.C. Penney Company
- Reatha Clark King, former chairman, Board of Trustees, General Mills Foundation
- Philip E. Lippincott, retired Chairman of the Board, Scott Paper Company and Campbell Soup Company
- Henry A. McKinnell, Jr., Chairman of the Board and CEO, Pfizer
- Marilyn Carlson Nelson, Chairman and CEO, Carlson Companies
- Samuel J. Palmisano, Chairman of the Board, President and CEO, IBM Corporation
- Walter V. Shipley, retired Chairman of the Board, Chase Manhattan Corporation
- J. Stephen Simon, Senior Vice President, Exxon Mobil Corporation
- Rex W. Tillerson, Chairman of the Board and Chief Executive Officer, Exxon Mobil Corporation

Organization

ExxonMobil is organized functionally into a number of global operating divisions. These divisions are grouped into three categories for reference purposes:

- Upstream
- Downstream
- Chemical

Operating divisions by category are as follows:

- Upstream
  - ExxonMobil Exploration Company
  - ExxonMobil Development Company
  - ExxonMobil Production Company
  - ExxonMobil Gas and Power Marketing Company
  - ExxonMobil Upstream Research Company

- Downstream
  - ExxonMobil Refining and Supply Company
  - ExxonMobil Fuels Marketing Company
  - ExxonMobil Lubricants & Specialties Company
  - ExxonMobil Research and Engineering Company
  - ExxonMobil Global Services Company

- Chemical
  - ExxonMobil Chemical Company

Upstream and Chemical operations are headquartered in Houston, Texas, and the downstream operations are headquartered at the heritage-Mobil headquarters in Fairfax, Virginia.

Largest shareholders

As of June 30, 2006:

Owner	Percent
Barclays Global Investors	4.0
State Street Global Advisors	3.1
Vanguard Group	2.6
Fidelity Management and Research	1.5
Northern Trust Company	1.4
AllianceBernstein	1.4

JPMorgan Chase	1.3
Wellington Management Company	1.1
Capital Research & Management Company	1.0
Merrill Lynch Investment Management	0.9
Bank of America	0.8
TIAA-CREF Investment Management	0.7
Mellon Financial	0.6
Goldman Sachs	0.6
State Farm Insurance	0.6

Controversies

Funding of global warming skeptics

ExxonMobil has drawn criticism as a major funder of organizations campaigning against the scientific opinion that global warming is caused by the burning of fossil fuels. British newspaper *The Guardian* has reported that ExxonMobil has funded, among other groups skeptical of global warming, the Competitive Enterprise Institute, George C. Marshall Institute, Heartland Institute, Congress on Racial Equality, TechCentralStation.com, and International Policy Network.[2][3] The Union of Concerned Scientists released a report in 2007 finding that "ExxonMobil has funneled nearly $16 million between 1998 and 2005 to a network of 43 advocacy organizations that seek to confuse the public on global warming science."[4] The report argued that ExxonMobil uses disinformation tactics similar to those used by the tobacco industry in its denials of the link between lung cancer and smoking, saying that the company uses "many of the same organizations and personnel to cloud the scientific understanding of climate change and delay action on the issue."[4] These charges are consistent with a 1998 internal ExxonMobil strategy memo stating "Victory will be achieved when uncertainties in climate science become part of the conventional wisdom" for "average citizens" and "the media."[5] ExxonMobil's support for these organizations has also drawn condemnation by the Royal Society, the academy of sciences of the United Kingdom.[6]

In August 2006, the Wall Street Journal [14][15] revealed that a YouTube video lampooning Al Gore, titled *Al Gore's Penguin Army*, appeared to be astroturfing by DCI Group, a Washington PR firm with ties to ExxonMobil as well as the Republican Party.

In January 2007 the company appeared to change its position, when vice president for public affairs Kenneth Cohen said "we know enough now — or, society knows enough now — that the risk is serious and action should be taken." Cohen stated that as of 2006, ExxonMobil had ceased funding of the Competitive Enterprise Institute and "'five or six' similar groups". [16]

On February 13 2007 ExxonMobil Chief Rex W. Tillerson acknowledged that the planet was warming while carbon dioxide levels were increasing, but in the same speech gave an unalloyed defense of the oil industry and predicted that hydrocarbons would dominate the world's transportation as energy demand grows by an expected 40 percent by 2030. Tillerson stated that there is no significant alternative to oil in coming decades, and that ExxonMobil would continue to make oil and natural gas its primary products.[7] "I'm no expert on biofuels. I don't know much about farming and I don't know much about moonshine," he said. "There is really nothing [ExxonMobil] can bring to that whole [biofuels] issue. We don't see a direct role for ourselves with today's technology," he said.[8]

Foreign business practices

Investigative reporting by *Forbes Magazine* raised questions about ExxonMobil's dealings with the leaders of oil-rich nations." ExxonMobil controls concessions covering 11 million acres (44,500 km^2) off the coast of Angola that hold an estimated 7.5 billion barrels (1.2 km^3) of crude.[9] *Forbes* alleged that "ExxonMobil handed hundreds of millions of dollars to the corrupt regime of President José Eduardo dos Santos in the late 1990s.[10][11][12][13] [14]

In 2003, the Office of Foreign Assets Control reported that ExxonMobil engaged in illegal trade with Sudan and it, along with dozens of other companies, settled with the United States government for $50,000.[15]

In March 2003, James Giffen of the Mercator Corporation was indicted, accused of bribing President Nursultan Nazarbayev of Kazakhstan with $78 million to help ExxonMobil win a 25 percent share of the Tengiz oilfield, the third largest in the world. On April 2, 2003, former-Mobil executive J. Bryan Williams was indicted on tax charges relating to this same transaction. The case is the largest under the Foreign Corrupt Practices Act.[16] This series of events is depicted in the film Syriana.

In a U.S. Department of Justice release dated September 18, 2003, the United States Attorney for the Southern District of New York announced that J. Bryan Williams, a former senior executive of Mobil Oil Corporation, had been sentenced to three years and ten months in prison on charges of evading income taxes on more than $7 million in unreported income, "including a $2 million kickback he received in connection with Mobil's oil business in Kazakhstan." According to documents filed with the court, Williams' unreported income included millions of dollars in kickbacks from governments, persons, and other entities with whom Williams conducted business while employed by Mobil. In addition to his sentence, Williams must pay a fine of $25,000 and more than $3.5 million in restitution to the IRS, in addition to penalties and interest.[[17]]

Valdez oil spill disaster

The March 24, 1989 Exxon Valdez oil spill was one of the most devastating man made environmental disasters ever to occur at sea. Exxon later removed the name "Exxon" from its tanker shipping subsidiary, which it renamed "SeaRiver Maritime." The renamed subsidiary, though wholly Exxon-controlled, has a separate corporate charter and board of directors, and the former *Exxon Valdez* is now the *SeaRiver Mediterranean*. The renamed tanker is legally owned by a small, allegedly under capitalized, stand-alone company, which would have minimal ability to pay out on claims in the event of a further accident.[17]

In 2006 U.S. Congressman Dave Reichert (WA-08) demanded ExxonMobil begin paying punitive damages it owes to 33,000 fishermen, businesses and affected communities waiting compensation agreed to by ExxonMobil as part of a 12-year old court case settling the damages.[18]

The U.S. Supreme Court let stand a $5 billion punitive damage verdict against ExxonMobil for its 1989 Exxon Valdez oil spill, rejecting without comment an appeal by the company on grounds of jury irregularities.[19]

Human rights record

ExxonMobil is the target of human rights activists for actions taken by the corporation in the Indonesian territory of Aceh. In June 2001 a lawsuit against ExxonMobil was filed in the Federal District Court of the District of Columbia under the Alien Tort Claims Act. The suit alleges that the ExxonMobil knowingly assisted human rights violations, including torture, murder and rape, by employing and providing material support to Indonesian military forces, who committed the alleged offenses during civil unrest in Aceh. Human rights complaints involving ExxonMobil's relationship with the Indonesian military first arose in 1992; the company denies these accusations and has filed a motion to dismiss the suit, which as of 2006 is still pending.[20]

Financial Data

Financial Data USD millions[21]

Year-end	2002	2003	2004	2005
Sales	204 506	237 054	291 252	358 955
EBITDA	26 038	41 220	51 646	70 181
Net income	11 460	21 510	25 330	36 130
Total Debt	10 748	9 545	8 293	7 991

See also

- Exxon Valdez oil spill

External links

General information

- ExxonMobil corporate website
  - Exxon USA website
  - Mobil global website
  - Esso global website
- History of Standard Oil spinoffs and their brands
- ExxonMobil's most recent conference call transcripts

Funding given by ExxonMobil

- ExxonMobil's list of funded organizations, 2005
- ExxonMobil's list of political contributions

Websites critical of ExxonMobil

- Bob Is the Oil Guy
- Exxonmobil entry at Knowmore.org
- Greenpeace UK's page on Esso
- ExxposeExxon by Defenders of Wildlife
- Stop Esso (dead link 10/28/06)
- Exxonsecrets.org by Greenpeace
  - List of organizations funded by Exxon Mobil
- As the World Burns, a *Mother Jones* special report on Exxon and global warming
- http://www.worldoutofbalance.org New documentary released which exposes ExxonMobil's impact on Climate Change
- http://www.consumersforpeace.org Consumers for Peace initiated the ExxonMobil War Boycott

ExxonMobil responses to issues

- ExxonMobil Web Page on Business Ethics & Standards
- ExxonMobil Web Page on Climate Change
- ExxonMobil Web Page on Valdez Oil Spill

References

1. ^ http://finance.yahoo.com/q/pr?s=XOM
2. ^ "Royal Society Letter to Exxon", *The Guardian*, September 20, 2006. Retrieved on 2006-10-18.
3. ^ "Claims by think-tank outrage eco-groups", *The Guardian*, November 28, 2004. Retrieved on 2007-1-16.
4. ^ ***a b*** "Scientists' Report Documents ExxonMobil's Tobacco like Disinformation Campaign on Global Warming Science", *Union of Concerned Scientists*, January 3, 2006. Retrieved on 2007-01-04.
5. ^ ExxonMobil. "Global Climate Science Communications." April 3, 1998.[1] See also Environmental Defense commentary "Guess who's funding the global warming doubt shops?"[2] and Cooperative Research history commons chronology of Exxon's PR efforts [3]
6. ^ "Royal Society tells Exxon: stop funding climate change denial", *The Royal Society*, September 4, 2006. Retrieved on 2006-10-18.
7. ^ Exxon Chief Cautions Against Rapid Action to Cut Carbon Emissions
8. ^ Exxon Mobil CEO: climate policy would be prudent
9. ^ ExxonMobil. Press release.[4]
10. ^ Forbes Magazine. "Dangerous Liaisons." April 28, 2003.[5]
11. ^ In May 2002, human rights advocates began calling for an investigation of the role of US oil companies and the Bush administration in Angola's "Arms for Oil" scandal. According to a report by the British-based non-governmental organization Global Witness, Bush and US oil interests had ties to some of the key figures in the arms-for-oil scandal. Global Witness alleged that in exchange for profitable off-shore oil concessions, ExxonMobil and other American and western European oil companies funded Angolan president Jose Eduardo dos Santos. After transferring an alleged $770 million in oil revenues to their own private bank accounts, dos Santos and his administration began a violent offensive against rebel groups in the country in which many human rights abuses were

inflicted on the Angolan people. from Co-op America

12. ^ Violation of the Bribes & Foreign Corrupt Practices Aact (ExxonMobil controls concessions covering 11 million acres (44,500 km²) off the coast of <Angola that hold an estimated 7.5 billion barrels (1.2 km³) of crude. from Search.com
13. ^ Even though Angola is the most effective of Africa's oil producers at retaining a high percentage of its oil wealth, its people get the least benefit from it. Much of that wealth has been mortgaged to pay for a long and destructive civil war. The lack of transparency of Angola's Government and its oil corporation, Sonangol, with the complicity of big oil companies, causes the rest to disappear without leaving much trace among Angola's poor. from Africa Files
14. ^ How Angolan State corruption and the lack of oil company and banking transparency has contributed to Angola's humanitarian and development catastrophe. from Africa Action
15. ^ CNN. "Wal-Mart, NY Yankees, others settle charges of illegal trading." April 14, 2003.[6]
16. ^ Foley & Lardner, LLP. "SEC and DOJ Enforcement Actions and Opinions." May 30, 2003.[7]
17. ^ The Baltimore Sun. "Even Renamed, Exxon Valdez can't Outlive Stain on its Past." October 15, 2002.[8]
18. ^ U.S. Congressman Dave Reichert. "Reichert Demands Compensation for Exxon Valdez Spill." March 24, 2006.[9]
19. ^ Court Rejects Appeal Bid by ExxonMobil
20. ^ International Labor Rights Fund. "ExxonMobil: How the Company is Linked with Indonesian Military Killings, Torture and other Severe Abuse in Aceh, Indonesia."[10]
21. ^ http://www.opesc.org/siteFiches/fiche.php?entreprise=EXXON

Bibliography

- Bender, Rob, and Tammy Cannoy-Bender. *An Unauthorized Guide to: Mobil Collectibles — Chasing the Red Horse*. Atglen, Pennsylvania: Schiffer Publishing Company, 1999.
- Exxon Corporation. *Century of Discovery: An Exxon Album*. 1982.
- Gibb, George S., and Evelyn H. Knowlton. *The Resurgent Years, 1911-1927: History of Standard Oil Company (New Jersey)*. New York: Harper & Brothers Publishers, 1956.
- Hidy, Ralph W., and Muriel E. Hidy. *Pioneering in Big Business, 1882-1911: History of Standard Oil Company (New Jersey)*. New York: Harper & Brothers Publishers, 1955.
- Larson, Henrietta M., and Kenneth Wiggins Porter. *History of Humble Oil & Refining Company: A Study in Industrial Growth*. New York: Harper & Brothers Publishers, 1959.
- Larson, Henrietta M., Evelyn H. Knowlton, and Charles S. Popple. *New Horizons, 1927-1950: History of Standard Oil Company (New Jersey)*. New York: Harper & Row, 1971.
- McIntyre, J. Sam. *The Esso Collectibles Handbook: Memorabilia from Standard Oil of New Jersey*. Atglen, Pennsylvania: Schiffer Publishing Company, 1998.
- Sampson, Anthony. *The Seven Sisters: The 100-year Battle for the World's Oil Supply*. New York: Bantom Books, 1991.
- Standard Oil Company (New Jersey). *Ships of the Esso Fleet in World War II*. 1946.
- Tarbell, Ida M. *All in a Day's Work: An Autobiography.*. New York: The MacMillan Company, 1939.
- Tarbell, Ida M., and David Mark Chalmers. *The History of the Standard Oil Company*. New York: Harper & Row, 1966.
- Wall, Bennett H. *Growth in a Changing Environment: A History of Standard Oil Company (New Jersey) 1950-1972 and Exxon Corporation (1972-1975)*. New York: McGraw-Hill Book Company, 1988.
- Yergin, Daniel. *The Prize: The Epic Quest for Oil, Money, and Power*. New York: Simon & Schuster, 1991.

Dow Jones Industrial Average [hide]

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Corporate Watch
16b Cherwell St
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Exxon Mobil - Overview

Exxon Mobil & Esso UK

Industry Area Oil and gas exploration, development and production.

Overview

Worldwide
The main activities of the ExxonMobil Group are exploration, production, transportation and sale of crude oil and natural gas as well as the manufacture, transportation and sale of petroleum products.

The group also manufactures and markets petrochemicals and participates in coal and minerals mining, and electric power generation.

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In 2000, 82% of the revenues came from refining and marketing; 10% from exploration and production; 8% from Chemicals, 8% and other revenues were nominal [1].

UK
Exploration and production is the largest business area of Esso in the UK. However, most of it is done as joint ventures with Shell, with Shell as the operator, so Esso isn't very visible. Compared to Exxon globally, the downstream and chemical part of their operations are smaller, 5% of total. Esso UK is the market leader in retailing and has the biggest refinery in the UK.

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Market share/importance

Worldwide
Exxon is the biggest not state owned oil and gas company in the world. According to the Time & Fortune Group's 2001 Fortune Global 500 list of the largest companies by revenue, it is the biggest corporation [2]. Worldwide it employs over 100,000 people.

Petroleum is mostly sold through Exxon's/Esso's service stations of which they have 45,000 in 118 countries. Aviation fuel is sold at more than 700 airports in 80 countries. ExxonMobil Marine Fuels serves more than 300 ports in 70 countries [3].

UK
Esso is the biggest petrol retailer in the UK with 1620 stations, of which 878 are company owned. Around 70% of the population live within a mere two miles of an Esso petrol station. According to Esso, their Snack 'n' Shop chain (part of their petrol stations) is the largest chain of shops in the oil industry.

Esso produce 10% of UK oil and gas, while over 15% of all oil products used in Britain come from their refinery in Fawley. As for gas, Esso supplies almost 9% of the total gas used by UK consumers.

Esso employs about 2800 people. Added to that amount is the significant number employed by subsidiary companies and contractors working on Esso sites and projects.

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History

Worldwide
[This is brief summary and does not go into the history of the different ExxonMobil companies]

The history of Exxon and Mobile is that of a true corporate giant. It started when John D. Rockefeller and partners formed the Standard Oil Company (1870). By 1878 Standard Oil controlled 95% of the US refining capacity [4]. This had largely been achieved by swallowing all competitors, and getting secret rebates from oil and making 'drawback' agreements with the railroad [5]. In 1989, Standard Oil officials were indicted for violating state anti monopoly laws. Standard Oil was not convicted, but this marked the beginning of several attempts to curb its power.

In 1882 the Standard Oil Trust was formed. It was the first trust ever formed and was constructed to circumvent Ohio laws restricting ownership of out of state companies. In 1890 the Sherman Antitrust Act was passed largely in response to Standard Oil's monopoly. The U.S. Supreme Court finally broke up the Standard Oil trust in 1911 into 34 different companies. The ownership group however, stayed largely the same. Two of the spin-off companies were Jersey Standard and Socony, the chief predecessor companies of Exxon and Mobil respectively. Over the years the two companies spread their interests to all over the world [6].

During the 1930s when Walter C. Teagle was head of Standard Oil, the company forged close ties with I.G. Farben, a firm that supported the Nazis and used concentration camp labour. Charles Higham (a former New York Times writer and biographer) writes in his book Trading With the Enemy: 'From the 1920s on Teagle showed a marked admiration for Germany's enterprise in overcoming the destructive terms of the Versaille Treaty. His lumbering stride, booming tones, and clouds of cigar smoke became widely and affectionately known in the circles that helped support the rising Nazi Party' [7]. Exxon Mobil's website prefers to describe how 'Each company [Jersey Standard and Socony-Vacuum] beefed up refining output to supply the Allied war effort [8].'

In 1931 Socony purchased assets of Vacuum Oil and changed its name to Socony-Vacuum. Socony-Vacuum became Socony Mobil Oil Co. in 1955 and, in 1966, simply Mobil Oil Corp.

Jersey Standard changed its name to Exxon Corporation in 1972 and established Exxon as a trademark throughout the United States. In other parts of the world its affiliated companies continued to use the Esso trademark.

In the 1970s, Exxon, Mobil and other companies escalated exploration and development outside the Middle East - in the North Sea, the Gulf of Mexico, Africa and Asia [9].

The biggest public scandal to hit Exxon so far came with the Exxon Valdez oil spill in 1989 (see Case Study and Corporate Crimes below).

In 1998, Exxon and Mobil signed a definitive agreement to merge and form a new company called Exxon Mobil Corporation. 'This merger will enhance our ability to be an effective global competitor in a volatile world economy and in an industry that is more and more competitive,' was the comment of Lee Raymond and Lou Noto, chairmen and chief executive officers of Exxon and Mobil respectively. After shareholder and regulatory approvals, the merger was completed in November 1999 [10].

UK

Esso started as the Anglo-American Oil Company in 1888, producing oil for kerosene lamps. It was only in 1951 that they became known as Esso. Following the merger of Exxon and Mobil in December 1999, it is now a part of the Exxon Mobil Corporation.

Esso has now finalised an alliance with Tesco (See Corporate Watch profile of Tesco Plc). Although Tesco claims that it no longer sourcs its petrol from Esso in its own brand petrol stations, their alliance sees Tesco Express forecourt shops on the grounds of Esso petrol stations.

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References

[1] Corporate Information: http://profiles.wisi.com/profiles/scripts/corpinfo.asp?CUSIP=30231G102
[2] www.fortune.com, viewed 31.08.01
[3] ExxonMobil annual report 2000, p. 19
[4] Corporate History p. 427
[5] Titan: The Life of John D. Rockefeller Sr., by Ron Chernow, gives a more detailed explanation of this. Read it online at www.micheloud.com/FXM/SO/rock.htm
[6] Corporate History p. 427
[7] EXXON: THE OIL KING, John Summa, published by Multinational Monitor, www.essential.org/monitor/hyper/issues/1989/01/mm0189_10.html

[8] ExxonMobil's web site, www.exxonmobil.com/emhistory, viewed 1/9/01
[9] ibid.
[10] ibid.

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CHEMICAL TRADE NAMES AND COMMERCIAL SYNONYMS

A Dictionary of American Usage

by

WILLIAMS HAYNES

D. VAN NOSTRAND COMPANY, INC.
TORONTO NEW YORK LONDON

NEW YORK

D. Van Nostrand Company, Inc., 250 Fourth Avenue, New York 3

TORONTO

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SUGGESTIONS TO USERS OF THIS BOOK

This book needs neither a Preface nor an Introduction, but an explanation of its scope and form should be helpful. Though its title is quite accurately descriptive, it needs more precise definition. "Chemical," for example, is a notoriously elastic adjective. A brief description of the book's contents and arrangement will enable you to refer to it with confidence.

As every research worker quickly learns, "negative data" are useful in that they save time by telling us what not to do. This book is not a chemical dictionary. Accordingly, you will look in vain here for "sodium hyposulfite" or its strictly chemical synonym, "sodium thiosulfite."

You will, however, find listed this chemical's commercial synonyms, "hypo" and "anticblor" and the trade name "Hyporice (Mallinckrodt): sodium hyposulfite; photographic developer," which means that Hyporice is sodium hyposulfite made by the Mallinckrodt Chemical Works and sold specifically through the photographic trade as a developing agent. By reference to the Index of Manufacturers, you find this firm's address: 2nd and Mallinckrodt Streets, St. Louis, Missouri.

This example serves to make clear how the commercial synonyms and the trade names are distinguished in the following pages. The former are entered with a small first letter; the latter with a capital first letter. Furthermore each trade name is immediately followed by a key word or initials in parenthesis which indicates the firm that controls or uses this particular trade or brand name.

It has of late become a necessitous habit to call many chemicals, especially complex organic compounds, by initials which recall their proper, multisyllabic names. It began, I recall, with the use of "DPG" for diphenylguanidine when it was introduced as a rubber accelerator some score of years ago. "DDT" for the insecticide dichlorodiphenyl-trichloroethane is a familiar current example of this usage. Although it is typographically obligatory to print these nicknames of the laboratory in capital letters -- reserved to indicate trade names -- the fact that they are in common use, true generic terms, is shown by the absence behind them of the manufacturer's key in parenthesis.

The nomenclature of the organic compounds becomes increasingly complex and is confused by different systems which have their stout advocates. There is a marked tendency to use names that make unmistakably plain the structure as well as the composition of these chemicals. As a result, many of the older terms of organic chemistry tend to become commercial terms. The transition of "carbolic acid" to "phenol" to "phenyl hydrate" to "hydroxybenzene" illustrates this tendency. Having in mind the layman who will consult these pages, a number of the more common of these older, familiar terms have been included.

Of the making of chemical trade names there is no end. For sound commercial reasons manufacturers seek to identify their product quickly and unmistakably. This practice is encouraged by the increasing complexity of compounds; by the increasing commercial development of specialties; and by the increasing efforts of makers to sell to the ultimate consumer. In the sharp competitive battle, the trade name has proved a valuable weapon. Trade-named specialties, manufactured and marketed by the largest producers of the standard, old-line heavy chemicals, are now sold in the household, the automotive, and the agricultural fields. These coined words are widely employed to designate a great variety of coatings, lubricants, and fabrics.

The terms listed in this book are confined to the chemicals and the chemical specialties sold in the industrial field. It includes a host of specialties used in the textile, the metallurgical, the paint and varnish, the perfume and other industries. It does not include such specialties as shoe and furniture polishes, cleansing agents, moth repellents, flavoring extracts, etc., sold to the general public. There are naturally many borderline items. Many detergents are sold to laundries, to dairies, and to housewives. The rule has been to list those products that are sold to manufacturers, including farmers and orchardists, for use in their own productive operations.

A word as to the definitions - these comprise generally two parts, separated by a semicolon: first, the composition, and second, the chief uses. More and more manufacturers are revealing the composition or the formula of their specialties. In fact, in the case of chemicals sold for use in synthesis or further processing, knowledge of this sort is essential to the prospective buyer. Wherever this information is made available it is included.

The uses recorded are indicative rather than inclusive. For familiar chemicals or compounds they have frequently been omitted with the purpose of keeping this volume within bounds. The uses of many items are literally a legion and in many cases the applications are exceedingly specialized, so that users are urged to write the manufacturers direct -- hence the index with their addresses -- for detailed information. All the data supplied by them could not be practically included here.

This book has been compiled in the main from information supplied by the manufacturers themselves. Nearly five hundred letters of inquiry were sent out. To the vast majority of these the firms replied with price lists and catalogs. For their cordial cooperation I am most grateful.

The new registered trademarks as issued in The Patent Gazette and new products reported in Chemical & Engineering News, Chemical Engineering, and Chemical Industries have been currently checked to January 1950.

In the original checking of this great mass of data, I have had the valued assistance of Professor William Huber of the Textile Department of the Rhode Island School of Design and of Dr. Elbert Weaver of the faculty of Phillips Exeter Academy. My thanks are due, too, to my secretary, Miss Barbara Trumbull, for an extraordinary task of typing and assistance in proofreading and to Mrs. Haynes for the meticulous work of alphabetizing and proofreading.

It is the sins of omission that plague the author of a work of this sort, and despite all care to make this dictionary comprehensive within its particular field, I cannot hope that it is complete. With new terms and trade names coming into use almost daily, it is reasonable to look forward to subsequent editions to keep this reference work up-to-date, and I will appreciate it if users and manufacturers will call my attention to omissions.

Williams Haynes

Stonecrop Farm

Stonington, Conn.

KEY TO MANUFACTURERS
(with Addresses)

AAC: American Agricultural Chemical Co., 50 Church St., New York, N.Y.
A-D-M: Archer-Daniels-Midland Co., Roanoke Bldg., Minneapolis, Minn.
Abbot: S.L. Abbot Co., 135 King St., San Francisco, Calif.
Abrasive: Abrasive Div., Simons Saw Co., 5500 Tacony St., Philadelphia, Pa.
Accord: Accord Chemical Corp., Accord, Mass.
Acheson: Acheson Colloids Corp., Port Huron, Mich.
Acme Refin.: Acme Refining Co., W. 56th St., Cleveland, Ohio
Acme White Lead: Acme White Lead & Color Works, 8250 St. Aubin Ave., Detroit, Mich.
Addressograph: Addressograph-Multigraph Corp., Cleveland, Ohio
Adhesive: Adhesive Products Corp., 1660 Boone Ave., New York, N.Y.
Advance Solvents: Advance Solvents & Chemical Corp., 245 5th Ave., New York, N.Y.
Afta: Afta Solvents Corp., 470 W. 128th St., New York, N.Y.
Agfa: Agfa Ansco Corp., Binghamton, N.Y.
Agicide: Agicide Laboratories, 4668 Teutonia Ave., Milwaukee, Wis.
Agkem: Agkem, Inc., 506 E. Main St., Quincy, Ill.
Ahco: Arnold Hoffman & Co., Inc., 55 Canal St., Providence, R.I.
Air Reduction: Air Reduction Sales Co., 60 E. 42nd St., New York, N.Y.
Aktivin: Aktivin Div., Heyden Chemical Corp., 393 7th Ave., New York, N.Y.
Albi: Albi Chemical Corp., 9 Park Pl., New York, N.Y.
Alco: Alco Oil & Chemical Corp., Trenton Ave. & William St., Philadelphia, Pa.
Alembik: Ignace Alembik, 151 Central Park, W., New York, N.Y.
Algin: Algin Corp. of America, 24 State St., New York, N.Y.
Alkydol: Alkydol Laboratories, Inc., 3242 S. 50th Ave., Cicero, Ill.
Allied: Allied Chemical & Dye Corp., 61 Broadway, New York, N.Y.
Allied Asphalt: Allied Asphalt & Mineral Corp., 217 Broadway, New York, N.Y.
Allied Mills: Allied Mills, Inc., Board of Trade Bldg., Chicago, Ill.
Allison: William M. Allison & Co., 162 Water St., New York, N.Y.
Alox: Alox Corporation, Niagara Falls, N.Y.
Alpha: Alpha Corporation, Greenwich, Conn.
Alrose: Alrose Chemical Co., 180 Mill St., Cranston, R.I.
Alston-Lucas: Alston-Lucas Paint Co., 1031 N. Throop St., Chicago, Ill.
Althouse: Althouse Chemical Co., Pear St., Reading, Pa.
Aluminum: Aluminum Co. of America, Gulf Bldg., Pittsburgh, Pa.
Aluminum Flake: Aluminum Flake Co., 965 Worcester Road, Barberton, Ohio
Aluminum Ore: Aluminum Ore Co., 3300 Missouri St., East St. Louis, Ill.
Amalgamated: Amalgamated Chemical Corp., Ontario & Rorer Sts., Philadelphia, Pa.
Amecco: Amecco Chemicals, Inc., Henderson, Nev.
Amend: Amend Drug & Chemical Co., 117 E. 24th St., New York, N.Y.
Am. Algin: American Algin Products Co., Duluth, Minn.
Am. Aniline: American Aniline Products, Inc., 50 Union Sq. E., New York, N.Y.
Am. Aniline & Extract: American Aniline & Extract Co., Venango & F Sts., Philadelphia, Pa.
Am. Anode: American Anode, Inc., 60 Cherry St., Akron, Ohio
Am. Bitumuls: American Bitumuls Co., 200 Bush St., San Francisco, Calif.
Am.-British: American-British Chemical Supplies, Inc., 180 Madison Ave., New York, N.Y.
Am. Can: American Can Co., 230 Park Ave., New York, N.Y.
Am. Cellulose: American Cellulose Co., Pendleton Pike, Indianapolis, Ind.
Am. Chem. Paint: American Chemical Paint Co., Ambler, Pa.

Am. Chlorophyll: American Chlorophyll Co., Alexandria, Va.
Am. Cholesterol: American Cholesterol Products Co., Milltown, N.J.
Am. Colloid: American Colloid Corp., 919 N. Michigan Ave., Chicago, Ill.
Am. Crayon: American Crayon Co., 1706 Hayes Ave., Sandusky, Ohio
Am. Cyanamid: American Cyanamid & Chemical Corp., 30 Rockefeller Plaza, New York, N.Y.
Am. Dietaids: American Dietaids Co., Inc., Yonkers, N.Y.
Am. Disinfecting: American Disinfecting Co., Inc., Sedalia, Mo.
Am. Dyewood: American Dyewood Co., 22 E. 40th St., New York, N.Y.
Am. Enka: American Enka Corp., 206 Madison Ave., New York, N.Y.
Am. Extract: American Extract Co., Port Allegany, Pa.
Am. Firstoline: American Firstoline Corp., 420 Lexington Ave., New York, N.Y.
Am. Fluoride: American Fluoride Corp., 151 W. 19th St., New York, N.Y.
Am. Gum: American Gum Products Co., 500 5th Ave., New York, N.Y.
Am. Hard Rubber: American Hard Rubber Co., 11 Mercer St., New York, N.Y.
Am. LaFrance: American-LaFrance-Foamite Corp., 250 W. 57th St., New York, N.Y.
Am. Lanolin: American Lanolin Corp., 13 Railroad St., Lawrence, Mass.
Am. Lecithin: American Lecithin Co., 75 Varick St., New York, N.Y.
Am. Lumber: American Lumber & Treating Co., 332 S. Michigan Ave., Chicago, Ill.
Am. Machine: American Machine & Foundry Co., 511 5th Ave., New York, N.Y.
Am. Maize: American Maize-Products Co., 100 E. 42nd St., New York, N.Y.
Am. Marietta: American-Marietta Co., 3400 13th Ave., S.W., Seattle, Wash.
Am. Metal: American Metal Co., 61 Broadway, New York, N.Y.
Am. Minl. Spirits: American Mineral Spirits Co., 230 N. Michigan Ave., Chicago, Ill.
Am. Pipe: American Pipe & Construction Co., Box 3428, Terminal Annex, Los Angeles, Calif.
Am. Plastics: American Plastics Corp., 225 W. 34th St., New York, N.Y.
Am. Polymer: American Polymer Corp., 101 Foster St., Peabody, Mass.
Am. Potash: American Potash & Chemical Corp., 122 E. 42nd St., New York, N.Y.
Am. Prods. Mfg.: American Products Manufacturing Co., Oleander & Dublin Sts., New Orleans, La.
Am. Resinous: American Resinous Chemical Co., Peabody, Mass.
Am. Smelting: American Smelting & Refining Co., 120 Broadway, New York, N.Y.
Am. Solder: American Solder & Flux Co., 2152-4 E. Norris Ave., Philadelphia, Pa.
Am. Turpentine: American Turpentine & Tar Co., 52 Vanderbilt Ave., New York, N.Y.
Am. Viscose: American Viscose Co., 350 5th Ave., New York, N.Y.
Am. Zinc Sales: American Zinc Sales Co., 818 Olive St., St. Louis, Mo.
Ampion: Ampion Corporation, 47-02 5th St., Long Island City, N.Y.
Anders: Anders Chemical Corp., East Rutherford, N.J.
Anderson, F.E.: F.E. Anderson Oil Co., Portland, Conn.
Anderson-Prichard: Anderson Prichard Oil Corp., Apco Tower Bldg., Oklahoma City, Okla.
Anderson-Stolz: Anderson-Stolz Corp., 1731 Walnut St., Kansas City, Mo.
Andrews: W.R.E. Andrews Sales Co., 1505 Race St., Philadelphia, Pa.
Anfo: Anfo Company, 3129 Elmwood Ave., Oakland, Calif.
Angel: H. Reeve Angel & Co., 75 Spruce St., New York, N.Y.
Ansbacher: Ansbacher-Seigle Corp., Chestnut St., Rosebank, Staten Island, N.Y.
Ansul: Ansul Chemical Co., Marinette, Wis.
Antipyros: Antipyros Company, 1175 Manhattan Ave., Brooklyn, N.Y.
Antiseptol: Antiseptol Company, 5224 Northwest Highway, Chicago, Ill.
Apex: Apex Chemical Co., 225 W. 34th St., New York, N.Y.
Apex Motor: Apex Motor Fuel Co., 1401 W. North Ave., Chicago, Ill.
Aqua-Sec: Aqua-Sec Corporation, 1450 Broadway, New York, N.Y.
Arabol: Arabol Manufacturing Co., 110 E. 42nd St., New York, N.Y.
Arapahoe: Arapahoe Chemicals, Inc., 2800 Pearl St., Boulder, Colo.
Arco: Arco Company, 7303 Bessemer Ave., Cleveland, Ohio
Arista: Arista Oil Products Co., 135 Front St., New York, N.Y.
Ariz. Mineral: Arizona Mineral Corp., Yuma, Ariz.
Arkansas: Arkansas Company, 185 Foundry St., Newark, N.J.
Armour: Armour & Co., 1355 W. 31st St., Chicago, Ill.
Armstrong Cork: Armstrong Cork Products Co., 985 Concord Ave., Lancaster, Pa.
Aromatic: Aromatic Products, Inc., 15 E. 30th St., New York, N.Y.

Artic: Artic Chemical & Combustion Engineer Corp., 209 King St., Brooklyn, N.Y.
Ashcraft: Ashcraft-Wilkinson Company, Trust Co. of Georgia Bldg., Atlanta, Ga.
Asphalt: Asphalt Emulsion Service, Inc., 331 Madison Ave., New York, N.Y.
Assoc. Chemists: Associated Chemists, Inc., 1906 N. Halsted St., Chicago, Ill.
Atlantic Chem.: Atlantic Chemical Co., 2072 Smith St., Centerdale, R.I.
Atlantic Refin.: Atlantic Refining Co., 260 S. Broad St., Philadelphia, Pa.
Atlantic Research: Atlantic Research Corp., 812 N. Fairfax St., Alexandria, Va.
Atlas Powder: Atlas Powder Co., Delaware Trust Bldg., Wilmington, Del.
Atlas Refin: Atlas Refinery, Inc., 142 Lockwood St., Newark, N.J.
Attapulgus: Attapulgus Clay Co., Wilmington, Del.
Ault & Wiborg: Ault & Wiborg Div., Interchemical Corp., P.O. Box 17, Evanston Station, Cincinnati, Ohio

B.B. Chem.: B.B. Chemical Co., Cambridge, Mass.
Bachmeier: Bachmeier & Company, 438 W. 37th St., New York, N.Y.
Baer: Baer Brothers, 438 W. 37th St., New York, N.Y.
Baird & McGuire: Baird & McGuire, Inc., Holbrook, Mass.
Bakelite: Bakelite Corporation, 30 E. 42nd St., New York, N.Y.
Baker Castor Oil: Baker Castor Oil Co., 120 Broadway, New York, N.Y.
Baker, J.T.: J.T. Baker Chemical Co., Phillipsburgh, N.J.
Barium: Barium Reduction Corp., South Charleston, W.Va.
Baroid: Baroid Sales Div., National Lead Co., 830 Ducommun St., Los Angeles, Calif.
Barrett: Barrett Div., Allied Chemical & Dye Corp., 40 Rector St., New York, N.Y.
Basic: Basic Refractories, Inc., Hanna Bldg., Cleveland, Ohio
Bauer & Black: Bauer & Black Div., Kendall Co., 104 E. 25th St., New York, N.Y.
Baugh: Baugh Chemical Co., 25 S. Calvert St., Baltimore, Md.
Bausch & Lomb: Bausch & Lomb Optical Co., Rochester, N.Y.
Bay Chem.: Bay Chemical Co., 1048 Constance St., New Orleans, La.
Baylis: Walter S. Baylis, Huntington Park, Calif.
Beach: Beach Soap Co., 125 Lawrence St., Lawrence, Mass.
Beacon: Beacon Company, 89 Bickford St., Boston, Mass.
Becco: Becco Sales Corp., Station B, Buffalo, N.Y.
Beck: Arthur Beck Co., 6022 Blackstone Ave., Chicago, Ill.
Bee: Bee Chemical Co., 63 E. Lake St., Chicago, Ill.
Behr-Manning: Behr-Manning Corp., Troy, N.Y.
Bell: Bell Chemical Co., 19 W. 44th St., New York, N.Y.
Bell Tel.: Bell Telephone Laboratories, 463 West St., New York, N.Y.
Benda: George Benda, Inc., Boonton, N.J.
Bendix: Bendix Chemical Corp., 420 Lexington Ave., New York, N.Y.
Bennett: Arthur E. Bennett & Co., 109 W. Austin Ave., Chicago, Ill.
Bens: Bens Chemical Co., 415 Francis St., Jackson, Mich.
Benson: Benson Process Engineering Co., Eden, N.Y.
Berger: Louis J. Berger & Son, 733 Broadway, New York, N.Y.
Bergstrom: Bergstrom Trading Co., Inc., 233 Broadway, New York, N.Y.
Bernard: Bernard Color & Chemical Corp., 333 Hudson St., New York, N.Y.
Berry: Berry Brothers, 211 Lieb St., Detroit, Mich.
Bersworth: Bersworth Chemical Co., Framingham, Mass.
Bick: Bick & Company, Inc., 12th & Bern Sts., Reading, Pa.
Bihn: Bihn & Wolff Co., 4650 Almond St., Philadelphia, Pa.
Bingham: Bingham Brothers Co., 154 Nassau St., New York, N.Y.
Binney & Smith: Binney & Smith Co., 41 E. 42nd St., New York, N.Y.
Biofen: Biofen Laboratories, 14 6th St., Bridgeport, Conn.
Birk: Glover M. Birk, New Albany, Ind.
Bischoff: Ernst Bischoff Co., Inc., Ivoryton, Conn.
Blakeslee: G.S. Blakeslee & Co., 1842 52nd Ave., Cicero, Ill.
Blickman: S. Blickman, Inc., Weehauken, N.J.
Bloede: Victor G. Bloede Co., Inc., 701 Caton St., Baltimore, Md.
Blue Ridge: Blue Ridge Talc Co., Henry, Va.
Bocon: Bocon Chemical Co., 18 W. 37th St., New York, N.Y.
Bol: Bol, Ltd., 118 E. 25th St., New York, N.Y.
Boler: Boler Petroleum Co., Widener Bldg., Philadelphia, Pa.
Bopf-Whittam: Bopf-Whittam Corporation, 1135-53 W. Elizabeth Ave., Linden,

Borden: The Borden Company, 350 Madison Ave., New York, N.Y.
Borne Scrymser: Borne Scrymser Co., 632 S. Front St., Elizabeth, N.J.
Boston Varnish: Boston Varnish Co., Everett, Mass.
Boweys: Boweys, Inc., 401 W. Superior St., Chicago, Ill.
Bradford Penn: Bradford Penn Refining Corp., Brown Ave., Clarendon, Pa.
Brazil: Brazil Oiticica, Inc., 80 Broad St., New York, N.Y.
Breeze: Breeze Corporations, Inc., 41 S. 6th St., Newark, N.J.
Briggs: W. A. Briggs Bitumen Co., Inc., 3335 Richmond St., Philadelphia, Pa.
Bronze Powder: Bronze Powder Works Co., Elizabeth, N.J.
Brooklyn: Brooklyn Color Works, Morgan & Norman Aves., Brooklyn, N.Y.
Brown: Brown Company, 500 5th Ave., New York, N.Y.
Brown Petroleum: R. J. Brown Petroleum Co., 1416 Wittenberg St., St. Louis, Mo.
Bruning: Charles Bruning Co., Inc., 102 Reade St., New York, N.Y.
Bryant: Bryant Chemical Corp., 6 North St., North Quincy, Mass.
Buchanan: C. G. Buchanan Chemical Co., 4680 Baker Ave., Cincinnati, Ohio.
Buchsbaum: S. Buchsbaum & Co., 1737 S. Michigan Ave., Chicago, Ill.
Buckeye: Buckeye Products Co., 38 Main St., Cincinnati, Ohio.
Buckeye Fabric: Buckeye Fabric-Finishing Co., Coshocton, Ohio.
Buckingham: Buckingham Wax Corp., 51-03 Van Dam St., Long Island City, N.Y.
Buffalo Extract: Buffalo Extract & Supply Co., 717 Elk St., Buffalo, N.Y.
Burkart: Burkart-Schier Chemical Co., 1206-28 Chestnut St., Chattanooga, Tenn.
Burns: Allen Burns Co., 93 Inwood Pl., Buffalo, N.Y.
Buromin: Buromin Company, Hagan Bldg., Pittsburgh, Pa.

CCC: Carbide & Carbon Chemicals Corp., 30 E. 42nd St., New York, N.Y.
C. P. Chemical: C. P. Chemical Solvents, Inc., 60 Park Pl., Newark, N.J.
Cabell: Cabell Chemical Co., Commerce Ave. & 21st St., Huntington, W.Va.
Cabot, Godfrey: Godfrey L. Cabot, Inc., 77 Franklin St., Boston, Mass.
Cabot, Sam'l: Samuel Cabot, Inc., 141 Milk St., Boston, Mass.
Calco: Calco Chemical Div., American Cyanamid Co., Bound Brook, N.J.
Caled: Caled Products Co., Brentwood, Md.
Calgon: Calgon, Inc., Hagan Bldg., Pittsburgh, Pa.
Calman: Emil Calman Corp., 112 E. 19th St., New York, N.Y.
Calif. Ind. Minls.: California Industrial Minerals Co., Friant, Calif.
Calif. Spray: California Spray Chemical Co., Lucas & Ortho Way, Richmond, Calif.
Campbell: John Campbell & Co., 75 Hudson St., New York, N.Y.
Car. Aniline: Carolina Aniline & Extract Co., P.O. Box 2386, Charlotte, N.C.
Carbic: Carbic Color & Chemical Co., Inc., 451-453 Washington St., New York, N.Y.
Carbogen: Carbogen Chemical Co., Bell Terminal, Garwood, N.J.
Carbola: Carbola Chemical Co., Inc., Natural Bridge, N.Y.
Carboline: Carboline Company, 7603 Forsythe Blvd., St. Louis, Mo.
Carbolineum: Carbolineum Wood Preserving Co., 528 W. Highland St., Milwaukee, Wis.
Carbonic: Carbonic Products Co., Tulsa, Okla.
Carborundum: Carborundum Company, Niagara Falls, N.Y.
Cargille: R. P. Cargille, 118 Liberty St., New York, N.Y.
Carlisle: Carlisle Chemical Works, Reading Rd., Reading, Ohio.
Carman: Carman & Company, 629 W. 27th St., New York, N.Y.
Carpenter-Morton: Carpenter-Morton Company, 77 Sudbury St., Boston, Mass.
Case Hardening: Case Hardening Service Co., 2281 Scranton Rd., Cleveland, Ohio.
Casein: Casein Company Div., Borden Company, 350 Madison Ave., New York, N.Y.
Catalin: Catalin Corporation, 1 Park Ave., New York, N.Y.
Cataract: Cataract Chemical Co., Inc., 90 Rapin Pl., Buffalo, N.Y.
Celanese: Celanese Corp. of America, 180 Madison Ave., New York, N.Y.
Celcure: Celcure Wood Preserving Corp., 1040 E. 8th St., Jacksonville, Fla.
Celotex: Celotex Corporation, 919 N. Michigan Ave., Chicago, Ill.
Central Chem.: Central Chemical Corp. of Maryland, 29 N. Jonathan St., Hagerstown, Md.
Central Ill.: Central Illinois Laboratories, Inc., 200 Cornhill St., Peoria, Ill.

Central Solvents: Central Solvents & Chemicals Co., 2545 W. Congress St., Chicago, Ill.
Ceramic: Ceramic Color & Chemical Manufacturing Co., 13th St. & Pottery Ave., New Brighton, Pa.
Ceresit: Ceresit Waterproofing Corp., 512 S. Canal St., Chicago, Ill.
Champion Paper: Champion Paper & Fibre Co., Canton, N.C.
Chapman: A. D. Chapman & Co., Inc., 333 N. Michigan Ave., Chicago, Ill.
Chapman Chem.: Chapman Chemical Co., Dermon Bldg., Memphis, Tenn.
Charlotte: Charlotte Chemical Laboratories, Gilchrist Bldg., Charlotte, N.C.
Chem. Compound.: Chemical Compounding Corp., 262 Huron St., Brooklyn, N.Y.
Chem. Engineering: Chemical Engineering Corp., P.O. Box 1076, Dallas, Tex.
Chem. Process: Chemical Process Co., Redwood City, Calif.
Chem. Prods. Mfg.: Chemical Products Manufacturing Co., 8131 Oleander St., New Orleans, La.
Chemco: Chemco Photoproducts Co., Glen Cove, N.Y.
Chemco Prods.: Chemco Products Co., Inc., 1059 E. 76th St., Chicago, Ill.
Chemical & Pigment: Chemical & Pigment Co., St. Helena, Md.
Chemo Puro: Chemo Puro Manufacturing Co., 26-32 Skillman Ave., Long Island City, N.Y.
Chicago Copper: Chicago Copper & Chemical Co., Blue Island, Ill.
Chicago Sanitary: Chicago Sanitary Products Co., 3100 S. Troop St., Chicago, Ill.
Chilton: Chilton Paint Co., 109 15th Ave., New York, N.Y.
Chipman: Chipman Chemical Co., Bound Brook, N.J.
Chiris: Antoine Chiris Co., 115 E. 23rd St., New York, N.Y.
Chromium: Chromium Corp. of America, 120 Broadway, New York, N.Y.
Ciba: Ciba Company, 627 Greenwich St., New York, N.Y.
Cincinnati: Cincinnati Chemical Works, Inc., 165 Broadway, New York, N.Y.
Cinelin: Cinelin Company, 1036 S. White River Pkway., Indianapolis, Ind.
Cities Service: Cities Service Oil Co., Bartlesville, Okla.
City: City Chemical Co., 132 W. 22nd St., New York, N.Y.
Claflin: Alan A. Claflin, 88 Broad St., Boston, Mass.
Claire: Claire Manufacturing Co., 7640 Vincennes Ave., Chicago, Ill.
Clarkson: Clarkson Chemical Co., 213 Main St., Williamsport, Pa.
Cleanchem: Cleanchem Products Corp., 64 6th Ave., New York, N.Y.
Cliffs-Dow: Cliffs-Dow Chemical Co., Marquette, Mich.
Clifton: Clifton Chemical Co., 62 William St., New York, N.Y.
Clinchfield: Clinchfield Sand & Feldspar Co., Mercantile Bldg., Baltimore, Md.
Cloroben: Cloroben Corporation, 225 Mercer St., Jersey City, N.J.
Clorox: Clorox Chemical Co., 850 42nd Ave., Oakland, Calif.
Coen: Coen Company, W. P. Story Bldg., Los Angeles, Calif.
Colgate: Colgate-Palmolive-Peet Co., Hudson St., Jersey City, N.J.
Colledge: E. W. Colledge, 52 Vanderbilt Ave., New York, N.Y.
Collinsville: Collinsville Zinc Corp., Collinsville, Ill.
Colloid: Colloid Chemical Laboratories, Inc., 11 Broadway, New York, N.Y.
Colloidal Labs.: Colloidal Laboratories, Hollywood, Calif.
Colloidal Prods.: Colloidal Products Corp., 2598 Taylor St., San Francisco, Calif.
Colloids: Colloids, Inc., 396 Frelinghuysen Ave., Newark, N.J.
Colmonoy: Colmonoy, Inc., Los Nietos, Calif.
Colonial Alloys: Colonial Alloys Co., Trenton Ave. & E. Somerset St., Philadelphia, Pa.
Colt's: Plastics Dept., Colt's Patent Fire Arms Manufacturing Co., Hartford, Conn.
Columbia: Columbia Chemicals Div., Pittsburgh Plate Glass Co., Grant Bldg., Pittsburgh, Pa.
Columbian Carbon: Columbian Carbon Co., 41 E. 41st St., New York, N.Y.
Coml. Paste: Commercial Paste Co., Buttles & Michigan Aves., Columbus, Ohio.
Coml. Solvents: Commercial Solvents Corp., 17 E. 42nd St., New York, N.Y.
Commonwealth: Commonwealth Color & Chemical Co., 223 Nevins St., Brooklyn, N.Y.
Conewango: Conewango Refining Co., Warren, Pa.
Congoleum-Nairn: Congoleum-Nairn, Inc., Kearny, N.J.
Consolidated Feldspar: Consolidated Feldspar Corp., 28 W. State St., Trenton, N.J.
Consumers Glue: Consumers Glue Co., 24 S. Commercial St., St. Louis, Mo.
Continental Asbestos: Continental Asbestos & Refining Corp., 1 Madison Ave., New York, N.Y.

Continental Chem.: Continental Chemical Co., 86 Lexington Ave., Passaic, N.J.
Continental-Diamond: Continental-Diamond Fibre Co., Newark, Del.
Cordo: Cordo Chemical Corp., 34 Smith St., Norwalk, Conn.
Corn Prods.: Corn Products Refining Co., 17 Battery Pl., New York, N.Y.
Cornelius: Cornelius Products Co., 386 4th Ave., New York, N.Y.
Coulston: J. W. Coulston & Son, 15 E. 26th St., New York, N.Y.
Coupey: Eric Coupey, 20 Park Ave., New York, N.Y.
Cowles: Cowles Detergent Co., 7016 Euclid Ave., Cleveland, Ohio.
Crescent: Crescent Chemical Co., 2400 S. Swanson St., Philadelphia, Pa.
Crosby: Crosby Chemicals, Inc., De Ridder, La.
Crowley: Hervey L. Crowley & Co., 1 Central Ave., West Orange, N.J.
Crystal: Charles B. Crystal Co., 53 Park Pl., New York, N.Y.
Culligan: Culligan Zeolite Co., Northbrook, Ill.
Cuprinol: Cuprinol, Inc., 13 Spring St., Boston, Mass.
Curran: Curran Corporation, 6 Pleasant St., Malden, Mass.
Curry: Curry Brothers Oil Co., 22 Oliver St., Boston, Mass.
Cutler-Hammer: Cutler-Hammer, Inc., 315 N. 12th St., Milwaukee, Wis.

D & O: Dodge & Olcott, Inc., 180 Varick St., New York, N.Y.
Dalton: Dalton-Cooper, Inc., 200 W. 34th St., New York, N.Y.
Dan River: Dan River Mills, Inc., Danville, Va.
Danco: Gerard J. Danco, Inc., 5 E. 19th St., New York, N.Y.
Darco: Darco Corporation, 60 E. 42nd St., New York, N.Y.
Darling: Darling & Company, 4204 S. Ashland Ave., Chicago, Ill.
Davies: Davies Nitrate Co., Inc., 114 Liberty St., New York, N.Y.
Davies-Young: Davies-Young Soap Co., 400 N. Findlay St., Dayton, Ohio.
Davison: Davison Chemical Corp., 20 Hopkins Pl., Baltimore, Md.
Day: S. A. Day Manufacturing Co., 1485 Niagara St., Buffalo, N.Y.
Dayton: Dayton Oil Co., Box 851, Dayton, Ohio.
Deecy: Deecy Products Co., 120 Potter St., Cambridge, Mass.
Debls & Stein: Debls & Stein, 237 South St., Newark, N.J.
De Lore: De Lore Div., National Pigments & Chemical Co., 722 Chestnut St., St. Louis, Mo.
Delta: Delta Chemical Works, 23 W. 60th St., New York, N.Y.
Demo: Demo Laboratories, 8 West End Ave., Bogota, N.J.
Dennis: Martin Dennis Co., 859 Summer Ave., Newark, N.J.
Derris: Derris, Inc., 79 Wall St., New York, N.Y.
Detrex: Detrex Corporation, Box 501, Roosevelt Park Annex, Detroit, Mich.
Detroit White Lead: Detroit White Lead Works, 1960 E. Milwaukee St., Detroit, Mich.
Devoe: Devoe & Raynolds Co., 44th St. & 1st Ave., New York, N.Y.
Dewey & Almy: Dewey & Almy Chemical Co., 62 Whittemore Ave., Cambridge, Mass.
Dexter: Dexter Chemical Corp., 819 Edgewater Rd., New York, N.Y.
Diamond Alkali: Diamond Alkali Co., 535 Smithfield St., Pittsburgh, Pa.
Dicalite: Dicalite Company, 18 E. 48th St., New York, N.Y.
Dings & Schuster: Dings & Schuster, 17 John St., New York, N.Y.
Dispersions: Dispersions Process, Inc., 1230 6th Ave., New York, N.Y.
Distillation: Distillation Products, Inc., 755 Ridge Rd., W., Rochester, N.Y.
Distrib. & Trading: Distributing & Trading Co., Inc., 444 Madison Ave., New York, N.Y.
Diversey: Diversey Corporation, 53 W. Jackson Blvd., Chicago, Ill.
Doggett: Stanley Doggett, Inc., 75 Varick St., New York, N.Y.
Donahue: F. J. Donahue Varnish Co., 10586 Knodell Ave., Detroit, Mich.
Dolanize: Dolanize Company, 815 E. 139th St., New York, N.Y.
Dow: Dow Chemical Co., Midland, Mich.
Dow-Corning: Dow-Corning Company, Midland, Mich.
Drackett: Drackett Company, 5020 Spring Grove Ave., Cincinnati, Ohio.
Drakenfeld: B. F. Drakenfeld & Co., 45 Park Pl., New York, N.Y.
Draper: Draper Soap Co., 171 Front St., Pawtucket, R.I.
Drew: E. F. Drew & Co., Boonton, N.J.
Dreyer: P. R. Dreyer, Inc., 119 W. 19th St., New York, N.Y.
Drouillard: J. C. Drouillard Co., Rockefeller Bldg., Cleveland, Ohio.
Dry-Kold: Dry-Kold Refrigerating Co., Niles, Mich.
Dreyfus: L. A. Dreyfus Co., Rosebank, S. I., N.Y.
Ducas: B. P. Ducas Co., 207 Van Vorst St., Jersey City, N.J.
Duche: T. M. Duche & Sons, Inc., 117 Hudson St., New York, N.Y.
Dugas: Dugas Engineering Corp., Marinette, Wis.

Dunn: Thomas W. Dunn Co., Pearl & Dover Sts., New York, N.Y.
du Pont: E. I. du Pont de Nemours & Co., Wilmington, Del.
du Pont Semesan: du Pont Semesan Co., Wilmington, Del.
Dura: Dura Chemical Co., 11 W. 42nd St., New York, N.Y.
Durez: Durez Plastics & Chemicals Co., 250 Park Ave., New York, N.Y.
Durfee: W. C. Durfee Co., Inc., 114 Federal St., Boston, Mass.
Durite: Durite Plastics Div., Borden Co., 5000 Summerdale Ave., Philadelphia, Pa.

Eagle-Picher: Eagle-Picher Lead Co., American Bldg., Cincinnati, Ohio.
Eastern Industries: Eastern Industries Div., Jos. Turner & Co., Ridgefield, N.J.
Eaton: Eaton Chemical & Dyestuff Co., 1490 Franklin St., Detroit, Mich.
Edgar: Edgar Brothers Co., Metuchen, N.J.
Edwal: Edwal Laboratories, Inc., 732 Federal St., Chicago, Ill.
Egyptian: Egyptian Lacquer Manufacturing Co., 1270 6th Ave., New York, N.Y.
Electro-Metallurgical: Electro-Metallurgical Div., Union Carbide & Carbon Co., 30 E. 42nd St., New York, N.Y.
Electro-Tech.: Electro-Technical Products, Inc., Nutley, N.J.
Elgin: Elgin Softener Corp., 134 N. Grove Ave., Elgin, Ill.
Elroy Naval Stores: Elroy Naval Stores Co., Vidalia, Ga.
Emery: Emery Industries, Inc., Carew Tower, Cincinnati, Ohio.
Emeryville: Emeryville Chemical Co., 1269 66th St., Emeryville, Calif.
Empire: Empire Soap & Chemical Co., Plymouth Ave., Minneapolis, Minn.
Emulsol: Emulsol Corporation, 59 E. Madison St., Chicago, Ill.
English China Clay: English China Clays Sales Corp., 551 5th Ave., New York, N.Y.
English Mica: English Mica Co., 220 E. 42nd St., New York, N.Y.
Enjay: Enjay Company, 15 W. 51st St., New York, N.Y.
Enthone: Enthone, Inc., 442 Elm St., New Haven, Conn.
Equitable: Equitable Powder Manufacturing Co., East Alton, Ill.
Ernecke: Ernecke & Salmstein Co., 1611 N. Sheffield Ave., Chicago, Ill.
Eronel: Eronel Industries, 5714 W. Pico Blvd., Los Angeles, Calif.
Esso: Esso Standard Oil Co., 50 Rockefeller Plaza, New York, N.Y.
Estes: Webster C. Estes, 224 Lexington Ave., New York, N.Y.
Eston: Eston Chemicals, Inc., 3100 E. 26th St., Los Angeles, Calif.
Evans Lead: Evans Lead Corp., Charleston, W.Va.
Everett & Barron: Everett & Barron Co., 359 Eddy St., Providence, R.I.
Exolon: Exolon Company, 1000 E. Niagara St., Tonawanda, N.Y.

Faesy: Faesy & Bestoff, Inc., 220 E. 42nd St., New York, N.Y.
Fairmount: Fairmount Chemical Co., 600 Ferry St., Newark, N.J.
Falk: Falk & Company, Box 1075, Pittsburgh, Pa.
Fallek: Fallek Products Co., 165 Broadway, New York, N.Y.
Falls: Falls Chemical Products Co., Oconto Falls, Wis.
Fannon: J. L. Fannon Co., 1321 W. Tioga St., Philadelphia, Pa.
Fansteel: Fansteel Metallurgical Corp., 2200 Sheridan Rd., North Chicago, Ill.
Farchan: Farchan Research Laboratories, 607 E. 127th St., Cleveland, Ohio.
Federal: Federal Color Laboratories, Inc., 4633 Forest Ave., Cincinnati, Ohio.
Feedwaters: Feedwaters, Inc., 140 Cedar St., New York, N.Y.
Felt: Felt Products Co., 1504 Carroll Ave., Chicago, Ill.
Felton: Felton Chemical Co., 603 Johnson Ave., Brooklyn, N.Y.
Felton, Sibley: Felton, Sibley & Co., 136 N. 4th St., Philadelphia, Pa.
Ferdinand: L. W. Ferdinand & Co., Inc., Lower Newton Falls, Mass.
Fergusson: Alex C. Fergusson Co., 450 Chestnut St., Philadelphia, Pa.
Ferro: Ferro Enamel Corp., 4150 E. 56th St., Cleveland, Ohio.
Ferro-Nil: Ferro-Nil Corporation, 381 4th Ave., New York, N.Y.
Fiber Chem.: Fiber Chemical Corp., Cliffwood, N.J.
Fiberloid: Fiberloid Div., Monsanto Chemical Co., Indian Orchard, Mass.
Fidelity: Fidelity Chemical Products Corp., 430 Riverside Ave., Newark, N.J.
Filmite: Filmite Oil Corp., Milwaukee, Wis.
Filtrol: Filtrol Corporation, 634 S. Spring St., Los Angeles, Calif.
Finch: Leon Finch, Ltd., 728 E. 59th St., Los Angeles, Calif.
Fine Organics: Fine Organics, Inc., 211 E. 19th St., New York, N.Y.

Firestone: Firestone Tire & Rubber Co., Akron, Ohio.
Firmenich: Firmenich & Company, 135 5th Ave., New York, N.Y.
Fisher: Fisher Scientific Co., 711-723 Forbes St., Pittsburgh, Pa.
Fiske: Fiske Brothers Refining Co., 122 Lockwood St., Newark, N.J.
Flintkote: Flintkote Company, 30 Rockefeller Plaza, New York, N.Y.
Florasynth: Florasynth Laboratories, Inc., 1533 Olmsted Ave., New York, N.Y.
Floridin: Floridin Company, 222 Liberty St., Warren, Pa.
Food Matls.: Food Materials Corp., 2521 W. 48th St., Chicago, Ill.
Foote: Foote Mineral Co., Germantown Trust Co. Bldg., Philadelphia, Pa.
Forest Prods.: Forest Products Chemical Co., Memphis, Tenn.
Formica: Formica Insulation Co., 4600 Spring Grove Ave., Cincinnati, Ohio.
Fox: M. Ewing Fox & Co., 240 E. 136th St., New York, N.Y.
Foy: Foy Electro-Chemical Co., P.O. Box 164, Ansonia, Conn.
Franco-Am.: Franco-American Div., Pennsylvania Alcohol & Chemical Corp., Berry Ave., Carlstadt, N.J.
Franklin Mineral: Franklin Mineral Products Co., Franklin, N.C.
Franklin Research: Franklin Research Co., 5134 Lancaster Ave., Philadelphia, Pa.
Freedom: Freedom-Valvoline Oil Co., Peoples Bldg., Pittsburgh, Pa.
French, Benj.: Benj. French, Inc., 160 5th Ave., New York, N.Y.
Fries: Fries Brothers, Inc., 92 Reade St., New York, N.Y.
Fries & Fries: Fries & Fries, 110 E. 70th St., Cincinnati, Ohio.
Fritzsche: Fritzsche Brothers, Inc., 76 9th Ave., New York, N.Y.
Fuld: Fuld Brothers, 702-710 S. Wolf St., Baltimore, Md.
Fur Processing: Fur Processing Corp., Danbury, Conn.
Furane: Furane Plastics & Chemicals Co., 719 W. Broadway, Glendale, Calif.

G & A: G & A Laboratories, Inc., Exley Ave., Savannah, Ga.
G. E.: General Electric Co., River Rd., Schenectady, N.Y.
Ga. Kaolin: Georgia Kaolin Co., 433 N. Broad St., Elizabeth, N.J.
Ga. Pine: Georgia Pine Turpentine Co., 52 Vanderbilt Ave., New York, N.Y.
Garfield: Garfield Manufacturing Co., Garfield, N.J.
Geigy: Geigy Company, Inc., 89-91 Barclay St., New York, N.Y.
Gelien: Gelien & Company, 92 Liberty St., New York, N.Y.
Gen. Abrasive: General Abrasive Co., Inc., 2107 College Ave., Niagara Falls, N.Y.
Gen. Aniline: Gen. Aniline & Film Corp., 435 Hudson St., New York, N.Y.
Gen. Atlas Carbon: General Atlas Carbon Div., General Properties Co., Pampa, Tex.
Gen. Chem.: General Chemical Div., Allied Chemical & Dye Corp., 40 Rector St., New York, N.Y.
Gen. Drug: Aromatics Div., General Drug Co., 644 Pacific St., Brooklyn, N.Y.
Gen. Dyes.: General Dyestuff Corp., 435 Hudson St., New York, N.Y.
Gen. Finishes: General Finishes, Inc., 1951 University Ave., St. Paul, Minn.
Gen. Mills: Chemical Div., General Mills, Inc., 400 2nd Ave. S., Minneapolis, Minn.
Gen. Naval: General Naval Stores Co., 230 Park Ave., New York, N.Y.
Gen. Plastics: General Plastics, Inc., North Tonawanda, N.Y.
Gen. Smelting: General Smelting Co., 2901 E. Westmoreland St., Philadelphia, Pa.
Gen. Tire: General Tire & Rubber Co., Akron, Ohio
Gen. Wax: General Wax Refining Co., 386 4th Ave., New York, N.Y.
Genseke: Genseke Brothers, Whipple St. & W. 48th Pl., Chicago, Ill.
Germo: Germo Manufacturing Co., 112 S. Main St., St. Louis, Mo.
Gilbreath: Gilbreath Chemical Co., 383 Bannon St., San Francisco, Calif.
Girdler: Girdler Corporation, 224 E. Broadway, Louisville, Ky.
Givaudan: Givaudan-Delawanna, Inc., 330 W. 42nd St., New York, N.Y.
Glidden: Glidden Company, Union Trust Bldg., Cleveland, Ohio.
Glyco: Glyco Products Co., 26 Court St., Brooklyn, N.Y.
Goldschmidt: Goldschmidt Chemical Corp., 153 Waverly Pl., New York, N.Y.
Good: James Good, Inc., 211 E. Susquehanna Ave., Philadelphia, Pa.
Goodrich: B. F. Goodrich Chemical Co., Rose Bldg., Cleveland, Ohio.
Goodrich, Wm.: William O. Goodrich Co., 3003 W. Hopkins Ave., Milwaukee, Wis.
Goodyear: Goodyear Tire & Rubber Co., Akron, Ohio.
Gordon: George C. Gordon Chemical Co., 1100 Hickory St., Kansas City, Mo.

Grand Ledge: Grand Ledge Paint Co., 208 W. Washington St., Grand Ledge, Mich.
Grant: Grant Photo Products, Inc., 395 4th Ave., New York, N.Y.
Graver: Graver Water Conditioning Div., Graver Tank & Manufacturing Co., Inc., 216 W. 14th St., New York, N.Y.
Gray: Wm. S. Gray & Co., 342 Madison Ave., New York, N.Y.
Great American: Great American Color Co., 2512 W. 9th St., Los Angeles, Calif.
Great Lakes: Great Lakes Varnish Works, Inc., 2207 N. Crawford Ave., Chicago, Ill.
Greeff: R. W. Greeff & Co., Inc., 10 E. 40th St., New York, N.Y.
Greenville: Greenville Chemical Co., Wallace Bldg., Greenville, S.C.
Griffin: Griffin Chemical Co., 1000 16th St., San Francisco, Calif.
Griffith: Griffith Laboratories, 1415 W. 37th St., Chicago, Ill.
Gulf: Gulf Refining Co., Gulf Bldg., Pittsburgh, Pa.
Gumputtie: Gumputtie Laboratories, 2217-21 Archer Ave., Chicago, Ill.

H-Van W-M: Hanson-Van Winkle-Munning Co., Matawan, N.J.
Haas-Miller: Haas-Miller Corporation, 4th & Bristol Sts., Philadelphia, Pa.
Hachmeister: Hachmeister Chemical Co., 2332 Forbes St., Pittsburgh, Pa.
Haering: D. W. Haering & Co., Inc., 205 W. Wacker Drive, Chicago, Ill.
Halco: Halco Chemical Corp., 551 5th Ave., New York, N.Y.
Hall, C. P.: C. P. Hall Co., 2510 1st Central Bldg., Akron, Ohio.
Halogen: Halogen Chemicals, Inc., 616 King St., Columbia, S.C.
Halowax: Halowax Corporation, 30 E. 42nd St., New York, N.Y.
Hamilton Labs.: Hamilton Laboratories, Inc., Asheville, N.C.
Hammerschlag: Hammerschlag Refining Co., 1776 Broadway, New York, N.Y.
Hammill: Hammill & Gillespie, 225 Broadway, New York, N.Y.
Handy & Harman: Handy & Harman, 82 Fulton St., New York, N.Y.
Hardesty: W. C. Hardesty Co., Inc., 41 E. 42nd St., New York, N.Y.
Harshaw: Harshaw Chemical Co., 1945 E. 97th St., Cleveland, Ohio.
Hart: Hart Products Corp., 1440 Broadway, New York, N.Y.
Hart & Harrington: Hart & Harrington, Inc., 925 Weed St., Chicago, Ill.
Hartman-Leddon: Hartman-Leddon Company, 6003 Girard Ave., Philadelphia, Pa.
Harwick: Harwick Standard Chemical Co., Akron Savings & Loan Bldg., Akron, Ohio.
Haskelite: Haskelite Manufacturing Co., 701 Ann St., N.W., Grand Rapids, Mich.
Hauthaway: C. L. Hauthaway & Sons Co., 638 Summer St., Lynn, Mass.
Haveg: Haveg Corporation, Newark, Del.
Haviland: Haviland Products Co., 421 Ann St., N.W., Grand Rapids, Mich.
Hayes Research: Hayes Research Co., Cambridge, Mass.
Haynes: C. W. Haynes Laboratories, Chandler St., Springfield, Mass.
Hazard Lead: Hazard Lead Works, Inc., Hazardville, Conn.
Heatbath: Heatbath Corporation, P.O. Box 78, Springfield, Mass.
Heim: Max B. Heim, 100 W. 58th St., New York, N.Y.
Heller: B. Heller & Co., 40th St. & Clairmont Ave., Chicago, Ill.
Henderson: Thomas Henderson, 284 Pearl St., New York, N.Y.
Hercules: Hercules Powder Co., Delaware Trust Bldg., Wilmington, Del.
Heresite: Heresite & Chemical Co., 822 S. 14th St., Manitowoc, Wis.
Herron: Herron Brothers & Meyer, 82 Beaver St., New York, N.Y.
Herstein: Herstein Laboratories, Inc., 128 Water St., New York, N.Y.
Heveatex: Heveatex Corporation, 78 Goodyear Ave., Melrose, Mass.
Hewitt: C. B. Hewitt & Brothers, 23 Green St., New York, N.Y.
Hewitt-Robins: Hewitt-Robins, Inc., 370 Lexington Ave., New York, N.Y.
Heyden: Heyden Chemical Corp., 393 7th Ave., New York, N.Y.
Hizone: Hizone Products, 1211 Washington St., Wilmette, Ill.
Holden: A. F. Holden Co., 52 Richards St., West Haven, Conn.
Holland: Holland Color & Chemical Co., Holland, Mich.
Holley: Holley Chemical Co., 122 E. 25th St., New York, N.Y.
Hooker: Hooker Electrochemical Co., Niagara Falls, N.Y.
Hooper: William E. Hooper & Sons, Juniper & Cherry Sts., Philadelphia, Pa.
Hopkins: J. L. Hopkins & Co., 220 Broadway, New York, N.Y.
Horn: A. C. Horn Co., 43-42 10th St., Long Island City, N.Y.
Horn Jeffreys: Horn Jeffreys & Co., 20 W. Burbank Blvd., Burbank, Calif.
Hortus: Hortus Products, Inc., Rutherford, N.J.
Houghton: E. F. Houghton & Co., 303 W. Lehigh Ave., Philadelphia, Pa.

Howe & French: Howe & French, Inc., 99 Broad St., Boston, Mass.
Huber: J. M. Huber, Inc., 460 W. 34th St., New York, N.Y.
Hudson Coal: Hudson Coal Co., 230 Park Ave., New York, N.Y.
Huisking: Chas. L. Huisking & Co., Inc., 155 Varick St., New York, N.Y.
Humble: Humble Oil & Refining Co., Humble Bldg., Houston, Tex.
Hungerford: Hungerford-Terry, Inc., Clayton, N.J.
Hunnewell: Hunnewell Soap Co., 14 W. 2nd St., Cincinnati, Ohio.
Hunt: Philip A. Hunt Co., 253 Russell St., Brooklyn, N.Y.
Huntington: Huntington Laboratories, Inc., 66 Tipton St., Huntington, Ind.
Huron: Huron Milling Co., 9 Park Pl., New York, N.Y.
Hutter: George F. Hutter Co., 384 Michigan Ave., Buffalo, N.Y.
Hycar: Hycar Chemical Co., 335 S. Main St., Akron, Ohio.
Hydrocarbon: Hydrocarbon Products Co., Inc., 500 5th Ave., New York, N.Y.
Hygrade: Hygrade Products Co., Inc., 35-35 35th St., Long Island City, N.Y.
Hyman: Julius Hyman Co., P.O. Box 2171, Denver, Colo.

ICI: Imperial Chemical Industries, Inc. of New York, 521 5th Ave., New York, N.Y.
Illinois Bronze: Illinois Bronze Powder Co., Inc., 564 W. Monroe St., Chicago, Ill.
Imperial: Pigment Color Div., Imperial Paper & Color Corp., Glens Falls, N.Y.
Imperial Oil: Imperial Oil & Gas Products Co., Grant Bldg., Pittsburgh, Pa.
Impervious: Impervious Varnish Co., Rochester, Pa.
Indoil: Indoil Chemical Co., 910 S. Michigan Ave., Chicago, Ill.
Industrial Chem.: Industrial Chemical Sales Div., West Virginia Pulp & Paper Co., 230 Park Ave., New York, N.Y.
Industrial Lubs.: Industrial Lubricants Co., 5736 12th St., Detroit, Mich.
Industrial Matls.: Industrial Materials Co., 1017 McCall St., Houston, Tex.
Industrial Paint: Industrial Paint Co., Haysville, Pa.
Industrial Prods.: Industrial Products, Inc., Box 1226, Greenville, S.C.
Industrial Raw Matls.: Industrial Raw Materials Corp., 52 Wall St., New York, N.Y.
Industrial Soap: Industrial Soap Co., 1501 S. 8th St., St. Louis, Mo.
Inland Mfg.: Inland Manufacturing Div., General Motors Corp., Dayton, Ohio.
Integrity: Integrity Paint Co., 294 State St., New Haven, Conn.
Interchemical: Interchemical Corporation, 75 Varick St., New York, N.Y.
Internatl. Cellucotton: International Cellucotton Products Co., 919 N. Michigan Ave., Chicago, Ill.
Internatl. Creosoting: International Creosoting & Construction Co., Galveston, Tex.
Internatl. Filter: International Filter Co., 325 W. 25th Pl., Chicago, Ill.
Internatl. Minerals: International Minerals & Chemical Corp., 20 N. Wacker Drive, Chicago, Ill.
Internatl. Paint: International Paint Co., Inc., 21 West St., New York, N.Y.
Internatl. Prods.: International Products Corp., 29 Broadway, New York, N.Y.
Internatl. Pulp: International Pulp Co., 41 Park Row, New York, N.Y.
Internatl. Rustproof: International Rustproof Co., 12509 Plover Ave., Cleveland, Ohio.
Internatl. Wax: International Wax Refining Co., 4415 Third Ave., Brooklyn, N.Y.
Interstate: Interstate Chemical Manufacturing Co., 35 N. 6th St., Reading, Pa.
Interstate Sanitation: Interstate Sanitation Co., 210 Post Sq., Cincinnati, Ohio.
Inversand: Inversand Company, Clayton, N.J.
Irvington: Irvington Varnish & Insulator Co., 6 Argyle Terrace, Irvington, N.J.
Isco: Innis, Speiden & Co., 117 Liberty St., New York, N.Y.

Jamieson: Jamieson Products Co., 219 Ave. F., Redondo Beach, Calif.
Jared-Holt: Jared-Holt Company, 107 Broad St., Albany, N.Y.

Jasons: Jasons Drug Co., 1085 Myrtle Ave., Brooklyn, N.Y.
Jelly: Walter H. Jelly & Co., 420 N. Western Ave., Chicago, Ill.
Johns-Manville: Johns-Manville Corporation, 22 E. 40th St., New York, N.Y.
Johnson, C. E.: Charles Eneu Johnson & Co., Lombard & 10th Sts., Philadelphia, Pa.
Johnson, Ivan T.: Ivan T. Johnson Co., Inc., 95 Madison Ave., New York, N.Y.
Johnson & Johnson: Filter Products Div., Johnson & Johnson, 4943 W. 65th St., Chicago, Ill.
Johnson Labs.: Johnson Laboratories, Inc., 414 S. Anderson St., Elwood, Ind.
Johnson-March: Johnson-March Corp., 9-17 43rd Ave., Long Island City, N.Y.
Johnson, S. C.: S. C. Johnson & Son, Inc., 1525 Howe St., Racine, Wis.
Jordan, Jr.: W. H. & F. Jordan, Jr., Manufacturing Co., 3047 Amber St., Philadelphia, Pa.
Joy: Joy Chemical Co., 133 Webster St., Pawtucket, R.I.

Kali: Kali Manufacturing Co., 427 Moyer St., Philadelphia, Pa.
Kay-Fries: Kay-Fries Chemicals, Inc., 180 Madison Ave., New York, N.Y.
Kearny: Kearny Manufacturing Co., Inc., 681 Schuyler Ave., Kearny, N.J.
Keery: Thomas Keery Co., Hancock, N.Y.
Kehew-Bradley: Kehew-Bradley Company, 43 Purchase St., Boston, Mass.
Keiner: Keiner & Company, 400 Adams St., Newark, N.J.
Kelco: Kelco Company, 31 Nassau St., New York, N.Y.
Kelley: Kelley Island Lime & Transport Co., Leader Bldg., Cleveland, Ohio.
Kellogg: E. H. Kellogg & Co., 93 Water St., New York, N.Y.
Kellogg, M. W.: M. W. Kellogg Co., Jersey City, N.J.
Kelsan: Kelsan Products, Inc., 1015 S. 6th St., St. Clair, Mich.
Kem: Kem Products Co., Inc., 229 High St., Newark, N.J.
Kendall: J. A. Kendall, 2nd Natl. Bank Bldg., Akron, Ohio.
Kepec: Kepec Chemical Corp., 1454 N. 4th St., Milwaukee, Wis.
Kerns: L. R. Kerns Co., 2657 E. 95th St., Chicago, Ill.
Kessler: Kessler Chemical Corp., State Rd. & Cottman Ave., Philadelphia, Pa.
Keystone Varnish: Keystone Varnish Co., 75 Otsego St., Brooklyn, N.Y.
King: E. & F. King & Co., 405 Atlantic Ave., Boston, Mass.
Kirk White: Kirk White Chemical Co., 121 W. 2nd St., Oconomowoc, Wis.
Klem: Klem Chemicals, Inc., 14401 Lanson Ave., Dearborn, Mich.
Klemm: Emil Klemm Co., Brooks Arcade, Salt Lake City, Utah.
Kodak: Eastman Kodak Co., 343 State St., Rochester, N.Y.
Kohnstamm: H. Kohnstamm & Co., Inc., 83-93 Park Pl., New York, N.Y.
Koppers: Koppers Company, Koppers Bldg., Pittsburgh, Pa.
Kraft: Kraft Food Co., 500 Peshtigo Court, Chicago, Ill.
Kraus: Armin J. Kraus, North Bergen, N.J.
Kuehne: Kuehne Chemical Co., Woodruff Lane, Elizabeth, N.J.
Ky. Color: Kentucky Color & Chemical Corp., 600 N. 34th St., Louisville, Ky.

Landers-Segal: Landers-Segal Color Co., 78 Delavan St., Brooklyn, N.Y.
Latan: Latan Chemicals, Inc., North Hackensack, N.J.
Latex: Latex Distributors, Inc., 1075 Hull St., Baltimore, Md.
Laucks: J. F. Laucks, Inc., Maritime Bldg., Seattle, Wash.
Laurel: Laurel Soap Manufacturing Co., Tioga, Almond & Thompson Sts., Philadelphia, Pa.
Laux: Laux Sales Co. Div., I. F. Laucks, Inc., 917 Western Ave., Seattle, Wash.
Lavanburg: Fred L. Lavanburg Div., Reichhold Chemicals, Inc., 601 Woodward Heights Blvd., Detroit, Mich.
Lawrence: W. W. Lawrence & Co., 1124 W. Carson St., Pittsburgh, Pa.
Lea: Lea Manufacturing Co., 16 Cherry Ave., Waterbury, Conn.
Leeming: Thomas Leeming & Co., Inc., 155 E. 44th St., New York, N.Y.
Lehn & Fink: Lehn & Fink Products Co., 200 Bloomfield Ave., Bloomfield, N.J.
Lesser: Rudolph W. Lesser, Inc., 90 State St., Albany, N.Y.
Lewis: Harry R. Lewis Co., Warren, Pa.
Lewis, John T.: John T. Lewis & Brothers Co., 2607 E. Cumberland St., Philadelphia, Pa.
L'Hommedieu: L'Hommedieu & Sons Co., 4251 Ogden Ave., Chicago, Ill.

Lincks: George H. Lincks, Inc., 155 John St., New York, N.Y.
Linde: Linde Air Products Co., 30 E. 42nd St., New York, N.Y.
Linick: Linick Chemical Co., 29 E. Madison St., Chicago, Ill.
Liquafill: Liquafill Manufacturing Co., 823 Richard St., Dayton, Ohio.
Liquid Conditioning: Liquid Conditioning Corp., 225 W. 34th St., New York, N.Y.
Lockery: Lockery Plastic Products Co., Flushing, N.Y.
Loewith: Julius Loewith, Inc., 120 E. 16th St., New York, N.Y.
Lotte: Lotte Chemical Co., Inc., 109 5th Ave., Paterson, N.J.
Lucas: John Lucas & Co., 322 Rose St., Philadelphia, Pa.
Lucidol: Lucidol Div., Novadel-Agene Corporation, 1740 Military Rd., Buffalo, N.Y.
Luxene: Luxene, Inc., 118 E. 25th St., New York, N.Y.

M-G-K: McLaughlin-Gormley-King Co., 1715 5th St., S.E., Minneapolis, Minn.
M. M. & R.: Magnus, Mabee & Reynard, 16 Desbrosses St., New York, N.Y.
Maas: A. R. Maas Chemical Co., 4570 Ardine St., South Gate, Calif.
Maas & Waldstein: Maas & Waldstein Co., 438 Riverside Ave., Newark, N.J.
MacDermid: MacDermid, Inc., Waterbury, Conn.
MacDermot: W. D. MacDermot Chemical Co., 81 Main St., Bristol, Conn.
Machinery Lubs.: Machinery Lubricants, Inc., 31 St. James St., Boston, Mass.
Mac-Lac: Mac-Lac Company, Inc., 127 Maiden Lane, New York, N.Y.
Magna: Magna Manufacturing Co., 444 Madison Ave., New York, N.Y.
Magnaflux: Magnaflux Corporation, 5900 Northwest Highway, Chicago, Ill.
Magnetic: Magnetic Pigment Co., 41 E. 42nd St., New York, N.Y.
Magnus Chemical Co., Garwood, N.J.
Magnuson: Magnuson Products Corp., 50 Court St., Brooklyn, N.Y.
Magruder: Magruder Color Co., 2385 Richmond Terrace, Port Richmond, N.Y.
Maher: Maher Color & Chemical Co., 355 W. Ontario St., Chicago, Ill.
Makalot: Makalot Corporation, 262 Washington St., Boston, Mass.
Mallinckrodt: Mallinckrodt Chemical Works, 2nd & Mallinckrodt Sts., St. Louis, Mo.
Malt: Malt Diastase Co., Decatur St. & Wyckoff Ave., Brooklyn, N.Y.
Manahan: Manahan Chemical Co., Inc., 57 N. 6th St., Brooklyn, N.Y.
Manhattan Rubber: Manhattan Rubber Manufacturing Div., Raybestos-Manhattan Inc., 120 Broadway, New York, N.Y.
Mann: George Mann & Co., Inc., 251 Fox Point Blvd., Providence, R.I.
Manguson: Manguson Products Co., 50 Court St., Brooklyn, N.Y.
Marathon: Chemical Div., Marathon Paper Mills Co., Rothschild, Wis.
Marblette: Marblette Corporation, 37-21 30th St., Long Island City, N.Y.
Marbon: Marbon Corporation, 1928 W. 10th Ave., Gary, Ind.
Marden-Wild: Marden-Wild Corporation, 500 Columbia St., Somerville, Mass.
Marietta-Harmon: Marietta-Harmon Chemicals, Inc., 550 Belmont Ave., Paterson, N.J.
Marlowe-Van Loan: Marlowe-Van Loan Corp., 1511 Byrum St., High Point, N.C.
Marstin: *Marstin Adhesive Co.*, 148 Old Colony Ave., Wollaston, Mass.
Martin: L. Martin Co., 41 E. 42nd St., New York, N.Y.
Martin, Glenn: Glenn L. Martin Co., Baltimore, Md.
Marx: Max Marx Color & Chemical Co., 192 Coit St., Irvington, N.J.
Maschmeijer: A. Maschmeijer, Jr., Inc., 43 W. 16th St., New York, N.Y.
Masonite: Masonite Corporation, Laurel, Miss.
Master: Master Builders Co., 7016 Euclid Ave., Cleveland, Ohio.
Masury: Masury Young Co., 76 Roland St., Boston, Mass.
Mathieson: Mathieson Chemical Corp., Mathieson Bldg., Baltimore, Md.
Maywood: Maywood Chemical Works, Maywood, N.J.
McAleer: McAleer Manufacturing Co., 4th & Water Sts., Rochester, Mich.
McCann: McCann Chemical Co., 712 W. Jefferson St., Louisville, Ky.
McConnon: McConnon & Company, 326 E. 3rd St., Winona, Minn.
McCormick: McCormick & Co., Inc., 414 Light St., Baltimore, Md.
McGean: McGean Chemical Co., Republic Bldg., Cleveland, Ohio.
McKay: McKay Chemical Co., 880 Pacific St., Brooklyn, N.Y.
Mearl: Mearl Corporation, 153 Waverly Pl., New York, N.Y.
Meincke: A. M. Meincke & Son, Inc., 7 S. Dearborn St., Chicago, Ill.
Merchants: Merchants Chemical Co., 435 N. Michigan Ave., Chicago, Ill.
Merck: Merck & Company, Rahway, N.J.
Merrell: William S. Merrell Co., Lockland Station, Cincinnati, Ohio.
Mertz: L. Carleton Mertz Co., 1638 S. Normal Ave., Chicago, Ill.
Metal Hydrides: Metal Hydrides, Inc., 12 Congress St., Beverly, Mass.
Metal & Thermit: Metal & Thermit Corp., 120 Broadway, New York, N.Y.

Metallurgical: Metallurgical Products Co., 35th & Moore Sts., Philadelphia, Pa.
Metasap: Metasap Chemical Co., 1st & Essex Sts., Harrison, N.J.
Mfrs. Oils: Manufacturers Oils, Inc., 531 Hamilton St., Allentown, Pa.
Mica: Mica Insulator Co., 157 Chambers St., New York, N.Y.
Mich. Chem.: Michigan Chemical Co., St. Louis, Mich.
Michel: M. Michel & Co., 90 Broad St., New York, N.Y.
Midland Color: Midland Color & Chemical Co., 545 W. 22nd St., New York, N.Y.
Midland Glue: Midland Glue Products Co., 1478 Madison Ave., Detroit, Mich.
Midland Labs.: Midland Chemical Laboratories, Inc., Dubuque, Iowa.
Miller: Miller Chemical & Fertilizer Corp., 1000 S. Caroline St., Baltimore, Md.
Miller, Carl: Carl F. Miller & Co., Inc., 1217 6th Ave., S., Seattle, Wash.
Millmaster: Millmaster Chemical Corp., 420 Lexington Ave., New York, N.Y.
Milwaukee Lubs.: Milwaukee Lubricants Co., 204 N. Broadway, Milwaukee, Wis.
Mine Safety: Mine Safety Appliances Co., 201 N. Braddock Ave., Pittsburgh, Pa.
Mineral Mining: Mineral Mining Corp., 90 Pine St., New York, N.Y.
Minn. Chem.: Minnesota Chemical Co., 2285 Hampden Ave., St. Paul, Minn.
Minnesota: Minnesota Mining & Manufacturing Co., 900 Fauquier Ave., St. Paul, Minn.
Monomer: Monomer-Polymer, Inc., 3430 Henderson St., Chicago, Ill.
Monroe: Monroe Chemical Co., 301 Oak St., Quincy, Ill.
Monsanto: Monsanto Chemical Co., 1700 S. 2nd St., St. Louis, Mo.
Moore & Munger: Moore & Munger, 33 Rector St., New York, N.Y.
Moores: Moores Lime Co., P.O. Box 878, Springfield, Ohio.
Moreland: Moreland Chemical Co., 814 W. Henry St., Spartanburg, S.C.
Morenci: Morenci Allied Products, Inc., Morenci, Mich.
Morningstar: Morningstar, Nicol, Inc., 630 W. 51st St., New York, N.Y.
Morton: Morton Chemical Co., P.O. Box 368, Greensboro, N.C.
Mountain: Mountain Copper Co., Ltd., 216 Pine St., San Francisco, Calif.
Murphy: Murphy Varnish Co., 224 McWhorter St., Newark, N.J.
Murray: Murray Oil Products Co., Margaret & Pearce Sts., Philadelphia, Pa.
Mutual: Mutual Chemical Co. of America, 270 Madison Ave., New York, N.Y.

N. Am. Phillips: North American Phillips Co., Inc., 100 E. 42nd St., New York, N.Y.
N. B. W.: Neumann-Buslee & Wolfe, 224-230 W. Huron St., Chicago, Ill.
N. H. Diatomite: New Hampshire Diatomite Co., Patriot Bldg., Concord, N.H.
N. J. Zinc: New Jersey Zinc Co., 160 Front St., New York, N.Y.
N. Y. Aromatics: New York Aromatics, Inc., 5 Beekman St., New York, N.Y.
N. Y. Color: New York Color & Chemical Div., American Dyewood Co., Belleville, N.J.
N. Y. Ornament: New York Ornament Co., 400 Columbus Ave., New York, N.Y.
Nason: R. N. Nason & Co., 151 Potrero St., San Francisco, Calif.
Natl. Adhesives: National Adhesives Div., National Starch Products, Inc., 270 Madison Ave., New York, N.Y.
Natl. Aniline: National Aniline Div., Allied Chemical & Dye Corp., 40 Rector St., New York, N.Y.
Natl. Aluminate: National Aluminate Corp., 6221 W. 66th Pl., Chicago, Ill.
Natl. Casein: National Casein Sales, Inc., 601-619 W. 80th St., Chicago, Ill.
Natl. Chem.: National Chemical Co., 1516 Industrial St., Los Angeles, Calif.
Natl. Gypsum: National Gypsum Co., 192 Delaware Ave., Buffalo, N.Y.
Natl. Lead: National Lead Co., 111 Broadway, New York, N.Y.
Natl. Pigment: *National Pigment & Chemical Co.*, 722 Chestnut St., St. Louis, Mo.
Natl. Research: National Research Corp., 70 Memorial Drive, Cambridge, Mass.
Natl. Rosin: National Rosin Oil Products, Inc., 1270 6th Ave., New York, N.Y.
Natl. Starch: National Starch Products Co., 270 Madison Ave., New York, N.Y.
Natl. Wax: National Wax Co., 1300 W. Division St., Chicago, Ill.
Natural Lime: Natural Lime & Stone Co., Findlay, Ohio.

Naugatuck Arom.: Naugatuck Aromatics Div., U.S. Rubber Co., 254 4th Ave., New York, N.Y.
Naugatuck Chem.: Naugatuck Chemical Div., U.S. Rubber Co., 1230 6th Ave., New York, N.Y.
Neatsfoot Oil: Neatsfoot Oil Refineries Corp., Ontario & Bath Sts., Philadelphia, Pa.
Neva-Wet: Neva-Wet Corp. of America, 30 Rockefeller Plaza, New York, N.Y.
Neville: Neville Company, Neville Island, Pittsburgh, Pa.
Newport: Newport Industries, Inc., P.O. Drawer 911, Pensacola, Fla.
Niacet: Niacet Chemicals Div., U.S. Vanadium Corp., 4750 Pine Ave., Niagara Falls, N.Y.
Niagara: Niagara Alkali Co., 60 E. 42nd St., New York, N.Y.
Niagara Chem.: Niagara Chemical Div., Food Machinery Corp., Middleport, N.Y.
Niagara Sprayer: Niagara Sprayer & Chemical Co., Middleport, N.Y.
Nicotine: Nicotine Manufacturing Co., Rialto Bldg., St. Louis, Mo.
Nielco: Nielco Chemical Corp., 19720 Florence Rd., Detroit, Mich.
Nielson: Nielson Chemical Co., 6564 Benson St., Detroit, Mich.
Nissen: John P. Nissen, Jr., Co., Glenside, Pa.
Nixon: Nixon Nitration Works, Nixon, N.J.
No-Wilt: No-Wilt Plant Products Co., North Olmstead, Ohio.
Nobs: Nobs Chemical Co., 838 E. Jefferson Blvd., Los Angeles, Calif.
Nopco: Nopco Chemical Co., 1st & Essex Sts., Harrison, N.J.
Norda: Norda Essential Oil & Chemical Co., 601 W. 26th St., New York, N.Y.
North: Frank G. North, Inc., P.O. Box 844, Atlanta, Ga.
North & Judd: North & Judd Manufacturing Co., New Britain, Conn.
Northern: Northern Regional Laboratory, U.S. Dept. of Agriculture, Washington, D.C.
Northwest: Northwest Lead Co., 1742-46 4th Ave., S., Seattle, Wash.
Norton: Norton Company, Worcester, Mass.
Nova: Nova Chemical Corp., 147-153 Waverly Pl., New York, N.Y.
Novadel: Novadel-Agene Corporation, 11 Mill St., Belleville, N.J.
Novocol: Novocol Chemical Manufacturing Co., Inc., 29-23 Atlantic Ave., Brooklyn, N.Y.
Nubian: Nubian Paint & Varnish Co., 1856 N. Leclaire Ave., Chicago, Ill.
Nulomoline: Nulomoline Company, 120 Wall St., New York, N.Y.
Nuodex: Nuodex Products Co., Inc., 830 Magnolia Ave., Elizabeth, N.J.
Nyanza: Nyanza Color & Chemical Co., Inc., 215 Water St., New York, N.Y.

Oakite: Oakite Products, Inc., 22 Thames St., New York, N.Y.
Oakland: Oakland Chemical Co., 59 4th Ave., New York, N.Y.
O'Connor: O'Connor & Kremp, 120 Greenwich St., New York, N.Y.
Ohio: Ohio Chemical & Manufacturing Co., 60 E. 42nd St., New York, N.Y.
Ohio-Apex: Ohio-Apex, Inc., Nitro, W. Va.
Ohio Bronze: Ohio Bronze Powder Co., 1120 E. 152nd St., Cleveland, Ohio.
Ohio Hydrate: Ohio Hydrate & Supply Co., Woodville, Ohio.
Onyx: Onyx Oil & Chemical Corp., Warren & Morris Sts., Jersey City, N.J.
Orelite: Orelite Company, 136 Liberty St., New York, N.Y.
Original Bradford: Original Bradford Soap Works, Inc., 200 Providence St., West Warwick, R.I.
Oronite: Oronite Chemical Co., 33 Sansome St., San Francisco, Calif.
Osborn: C. J. Osborn Co., 132 Nassau St., New York, N.Y.
Ox: Ox Color Works, 140 W. 42nd St., New York, N.Y.

P & G: Procter & Gamble Co., Gwynne Bldg., Cincinnati, Ohio.
Pabst: Pabst Sales Co., 221 N. LaSalle St., Chicago, Ill.
Pacific Coast Borax: Pacific Coast Borax Co., 51 Madison Ave., New York, N.Y.
Paisley: Paisley Products, Inc., 1770 Canalport Ave., Chicago, Ill.
Paispearl: Paispearl Products, Inc., 65 Nassau St., New York, N.Y.
Pan Am.: Pan American Refining Co., 122 E. 42nd St., New York, N.Y.
Pantasote: Pantasote Company, 444 Madison Ave., New York, N.Y.
Papermakers: Papermakers Div., Hercules Powder Co., Wilmington, Del.
Paramet: Paramet Chemical Corp., 10-17 44th Ave., Long Island City, N.Y.
Parento: Compagnie Parento, Inc., 68 Brook St., Croton-On-Hudson, N.Y.
Parfum: Parfum L'Orle, Inc., 6 E. 39th St., New York, N.Y.
Parker: Parker Rust-Proof Co., 2177 E. Milwaukee Ave., Detroit, Mich.
Parsons: Parsons & Plymouth Laboratory, 59 Beekman St., New York, N.Y.

Patek: Patek & Company, 1900 16th St., San Francisco, Calif.
Patent: Patent Chemicals, Inc., 335 McLean Blvd., Paterson, N.J.
Pearson-Ferguson: Pearson-Ferguson Chemical Co., Inc., 1400 Union Ave., Kansas City, Mo.
Pecora: Pecora Paint Co., 3400 N. 4th St., Philadelphia, Pa.
Peerless: Peerless Color Co., 521 North Ave., Plainfield, N.J.
Penetone: Penetone Company, 74 Hudson Ave., Tenafly, N.J.
Penick: S. B. Penick & Co., 50 Church St., New York, N.Y.
Penick & Ford: Penick & Ford, Ltd., Inc., 420 Lexington Ave., New York, N.Y.
Penn. Coal: Pennsylvania Coal Products Co., Petrolia, Pa.
Penn. Ind. Chem.: Pennsylvania Industrial Chemical Corp., 120 State St., Clairton, Pa.
Penn. Oil: Pennsylvania Oil Products Refining Co., Warren, Pa.
Penn. Refining: Pennsylvania Refining Co., Butler, Pa.
Penn. Salt: Pennsylvania Salt Manufacturing Co., Widener Bldg., Philadelphia, Pa.
Penola: Penola, Inc., 15 W. 51st St., New York, N.Y.
Periseal: Periseal Company, 25 W. 45th St., New York, N.Y.
Perkins: Perkins Soap Co., 210 Albany St., Springfield, Mass.
Perm-Aseptic: Perm-Aseptic Corporation, 432 Waverly Ave., Mamaroneck, N.Y.
Permanente: Permanente Metals Corp., Kaiser Bldg., Oakland, Calif.
Permutit: Permutit Company, 330 W. 42nd St., New York, N.Y.
Petroleum: Petroleum Products Refining & Producing Co., Box 13, Prewitt, N. Mex.
Petroleum By-Prods.: Petroleum By-Products & Chemical Co., 15 Whitehall St., New York, N.Y.
Petroleum Prods.: Petroleum Products Co., 54 Front St., New York, N.Y.
Petroleum Specialties: Petroleum Specialties, Inc., 400 Madison Ave., New York, N.Y.
Pfaltz & Bauer: Pfaltz & Bauer, 350 5th Ave., New York, N.Y.
Pfanstiehl: Pfanstiehl Chemical Co., 104 Lakeview Ave., Waukegan, Ill.
Pfizer: Charles Pfizer & Co., Inc., 81 Maiden Lane, New York, N.Y.
Pharma: Pharma Chemical Corp., 175 5th Ave., New York, N.Y.
Phelps Dodge: Phelps Dodge Copper Products Co., 40 Wall St., New York, N.Y.
Phenoglaze: Phenoglaze Sales Corp., 315 Broadway, New York, N.Y.
Phila. Quartz: Philadelphia Quartz Co., Public Ledger Bldg., Philadelphia, Pa.
Philippine: Philippine Refining Corp. of New York, 50 Broad St., New York, N.Y.
Phillips: Phillips Petroleum Co., Phillips Bldg., Bartlesville, Okla.
Phillips Chem.: Phillips Chemical Co., Lakeview Ave., Waukegan, Ill.
Phoenix: Phoenix Oil Co., 9505 Cosseus Ave., Cleveland, Ohio.
Pierce: F. O. Pierce Co., 2-33 50th Ave., Long Island City, N.Y.
Pioneer: Pioneer Pyrophyllate Producers, Chula Vista, Calif.
Pittsburgh: Pittsburgh Plate Glass Co., Grant Bldg., Pittsburgh, Pa.
Pittsburgh Grinding: Pittsburgh Grinding Wheel Co., Rochester, Pa.
Pittsburgh Steel: Pittsburgh Crushed Steel Co., 4839 Harrison St., Pittsburgh, Pa.
Planetary: Planetary Chemical Co., Creve Coeur, Mo.
Plant Prods.: Plant Products Co., Blue Point, L.I., N.Y.
Plaskon: Plaskon Div., Libbey, Owens, Ford Glass Co., 2112 Sylvan Ave., Toledo, Ohio.
Plastex: Plastex Adhesive Products, Inc., 728 64th St., Brooklyn, N.Y.
Plastic Metals: Plastic Metals, Inc., 153 Bridge St., Johnstown, Pa.
Polymer: Polymer Chemical Co., 5020 Carthage Ave., Cincinnati, Ohio.
Polymer Ind.: Polymer Industries, Inc., 11-08 30th Ave., Astoria, N.Y.
Porcelain: Porcelain Enamel & Manufacturing Co., Eastern & Pemco Ave., Baltimore, Md.
Portland Coke: Portland Gas & Coke Co., Public Service Bldg., Portland, Ore.
Portland Shingle: Portland Shingle Co., 9036 N. Denver Ave., Portland, Ore.
Potash: Potash Co. of America, 50 Broadway, New York, N.Y.
Poughkeepsie: Poughkeepsie Dyestuff Corp., 77 N. Water St., Poughkeepsie, N.Y.
Powell: John Powell & Co., 1 Park Ave., New York, N.Y.
Pratt: B. G. Pratt Co., 160 Moore St., Hackensack, N.J.
Pratt & Lambert: Pratt & Lambert, Inc., 75 Tonowanda St., Buffalo, N.Y.
Premier: Premier Color Works, 382 Pearl St., New York, N.Y.

Premier Prods.: Premier Products Co., 1211 N. Monroe St., Tallahassee, Fla.
Prentiss: R. J. Prentiss Co., 80 John St., New York, N.Y.
Price: Price Fire & Water Proofing Co., Union St., Poughkeepsie, N.Y.
Prince: Prince Manufacturing Co., Bowmanstown, Pa.
Protection Prods.: Protection Products Manufacturing Co., P.O. Box 747, Kalamazoo, Mich.
Protexol: Protexol Corporation, Kenilworth, N.J.
Providence: Providence Chemical Co., 2-8 Randall St., Providence, R.I.
Pruden: Pruden Chemical Co., P.O. Box 1106, Orlando, Fla.
Publicker: Publicker Industries, Inc., 1429 Walnut St., Philadelphia, Pa.
Pure Carbonic: Pure Carbonic, Inc., 60 E. 42nd St., New York, N.Y.
Pure Oil: Pure Oil Co., 35 E. Wacker Drive, Chicago, Ill.
Pylam: Pylam Products Co., 799 Greenwich St., New York, N.Y.
Pyrene: Pyrene Manufacturing Co., 560 Belmont Ave., Newark, N.J.
Pyroxylin: Pyroxylin Products, Inc., 4851 S. St. Louis Ave., Chicago, Ill.

Quaker: Quaker Chemical Products Co., Conshohocken, Pa.
Quaker Oats: Chemical Div., Quaker Oats Co., 141 W. Jackson Blvd., Chicago, Ill.
Quality: Quality Chemical Supply Co., 167 Trinity Ave., S.W., Atlanta, Ga.
Quigley: Quigley Company, 527 5th Ave., New York, N.Y.

R. B. H.: R. B. H. Dispersion Div., Interchemical Corporation, Factory Lane, Bound Brook, N.J.
R-S: R-S Laboratories, 711 S. Dearborn St., Chicago, Ill.
R-W-W: Reilly-Whiteman-Walton Co., P.O. Box 12, Conshocken, Pa.
Radium: Radium Chemical Co., 570 Lexington Ave., New York, N.Y.
Ralston: Ralston Purina Co., 835 S. 8th St., St. Louis, Mo.
Rampel: Rampel Chemical Co., 140 E. 3rd St., Mount Vernon, N.Y.
Rapter: Rapter Laboratories, P.O. Box 872, Argo, Ill.
Rare Chems.: Rare Chemicals, Inc., 1st & Essex Sts., Harrison, N.J.
Rayon Processing: Rayon Processing Co. of R.I., Inc., 86 Tremont St., Central Falls, R.I.
Rayonier: Rayonier, Inc., 122 E. 42nd St., New York, N.Y.
Reade: Reade Manufacturing Co., Inc., 135 Hoboken Ave., Jersey City, N.J.
Reardon: Reardon Industries, 2837 Stanton Ave., Walnut Hills, Cincinnati, Ohio.
Refined Prods.: Refined Products Corp., Lyndhurst, N.J.
Reichard: Reichard-Coulston, Inc., 15 E. 26th St., New York, N.Y.
Reichhold: Reichhold Chemicals, Inc., 601 Woodward Heights Blvd., Detroit, Mich.
Reilly: Reilly Tar & Chemical Corp., Merchants' Bank Bldg., Indianapolis, Ind.
Reliance: Reliance Chemical Products, Inc., East Providence, R.I.
Research Prods.: Research Products Corp., 370 Lexington Ave., New York, N.Y.
Resinous: Resinous Products & Chemical Co., 222 W. Washington Sq., Philadelphia, Pa.
Resistoflex: Resistoflex Corporation, 37 Planson St., Belleville, N.J.
Retort: Retort Chemical Co., P.O. Box 137, Gainesville, Fla.
Revertex: Revertex Corp. of America, 37-08 Northern Blvd., Long Island City, N.Y.
Revson: R. F. Revson Co., 234 W. 17th St., New York, N.Y.
Rheem: Rheem Research Products, Inc., Standard Oil Bldg., Baltimore, Md.
R. I. Blue: R. I. Blue Co., 178 Columbus Ave., Pawtucket, R.I.
Rhodes: James H. Rhodes & Co., 157 W. Hubbard St., Chicago, Ill.
Rhodes Chem.: Rhodes Chemical Corp., Jenkintown, Pa.
Richardson: Richardson Company, Lockland Station, Cincinnati, Ohio.
Riches: Riches-Nelson, Inc., 342 Madison Ave., New York, N.Y.
Richmond: Richmond Oil, Soap & Chemical Co., 1041 Frankford Ave., Philadelphia, Pa.
Ritter: F. Ritter & Co., 4641 Hollywood Blvd., Los Angeles, Calif.
Riverside: Riverside Chemical Co., 871 River Road, North Tonawanda, N.Y.
Riverside Mfg.: Riverside Manufacturing Co., 4919 Connecticut St., St. Louis, Mo.
Robins: G. S. Robins & Co., 126 Chouteau St., St. Louis, Mo.
Robinson-Wagner: Robinson-Wagner Company, 110 E. 42nd St., New York, N.Y.

Rochester: Rochester Germicide Co., 16 Dowling Place, Rochester, N.Y.
Rodriguez: R. E. Rodriguez, 56 Warren St., New York, N.Y.
Rogers: Rogers Corporation, Mill St., Manchester, Conn.
Rogers & Hubbard: Rogers & Hubbard Co., Portland, Conn.
Rohm & Haas: Rohm & Haas Co., 222 W. Washington Sq., Philadelphia, Pa.
Roosen: H. D. Roosen Co., 78 20th St., Brooklyn, N.Y.
Rosco: Rosco Laboratories, 367 Hudson Ave., Brooklyn, N.Y.
Ross: Frank B. Ross Co., 6 Ash St., Jersey City, N.J.
Ross & Rowe: Ross & Rowe, Inc., 50 Broadway, New York, N.Y.
Roure-Dupont: Roure-Dupont, Inc., 366 Madison Ave., New York, N.Y.
Rowe: Rowe & Company, 723 W. 26th St., Norfolk, Va.
Roxalin: Roxalin Flexible Finishes, Inc., 800 Magnolia Ave., Elizabeth, N.J.
Royce: Royce Chemical Co., Carlton Ave. & Herrick St., Carlton Hill, N.J.
Rubba: Rubba, Inc., 1015 E. 173rd St., New York, N.Y.
Rubbercraft: Rubbercraft Corp. of California, 114 E. 17th St., Los Angeles, Calif.
Ruehl: Ruehl Paint Co., 1008 Central Ave., Cincinnati, Ohio.
Rumford: Rumford Div., Heyden Chemical Works, 9 Newman Ave., Rumford, R.I.
Rust-Pruf: Rust-Pruf Company, 164 W. Lake St., Chicago, Ill.
Ryerson: Joseph T. Ryerson & Son, Inc., 2558 W. 16th St., Chicago, Ill.

S-W: Sherwin-Williams Company, 101 Prospect Ave., N.W., Cleveland, Ohio.
Sachs: Sachs Manufacturing Co., 1639 Forbes St., Pittsburgh, Pa.
Saginaw: Saginaw Salt Products Co., 806 Carrolton Road, Saginaw, Mich.
Salem: Salem Oil & Grease Co., 60 Grove St., Salem, Mass.
Salomon: L. A. Salomon & Bros., 216 Pearl St., New York, N.Y.
Sandoz: Sandoz Chemical Works, Inc., 61 Van Dam St., New York, N.Y.
Sapon: Sapon Laboratories, Inc., 543 Union St., Brooklyn, N.Y.
Sartorius: A. Sartorius & Co., 80 5th Ave., New York, N.Y.
Saxe-Rushworth: Saxe-Rushworth Co., Inc., 500 5th Ave., New York, N.Y.
Schaffer-Moss: Schaffer-Moss Chemical Corp., 1222 Shore Ave., Pittsburgh, Pa.
Scheel: William H. Scheel, Inc., 38 Franklin St., Brooklyn, N.Y.
Scher: Scher Brothers, 519 Getty Ave., Clifton, N.J.
Scholler: Scholler Brothers Co., Collins & Westmoreland Sts., Philadelphia, Pa.
Schreiber: Schreiber Milling & Grain Co., St. Joseph, Mo.
Schwartz Chem.: Schwartz Chemical Co., 326 W. 70th St., New York, N.Y.
Schwarz: Schwarz Laboratories, Inc., 202 E. 44th St., New York, N.Y.
Scientific Filter: Scientific Filter Co., 1 Franklin Sq., New York, N.Y.
Scientific Oil: Scientific Oil Compounding Co., 1637 S. Kilbourne Ave., Chicago, Ill.
Security: Security Manufacturing Co., 144 W. 27th St., New York, N.Y.
Seebach: Edwin Seebach Co., 912 Broadway, New York, N.Y.
Self-Vulcanizing: Self-Vulcanizing Rubber Co., Inc., 605 W. Washington Blvd., Chicago, Ill.
Service: Service Industries, Inc., 2103 E. Somerset St., Philadelphia, Pa.
Servwell: Servwell Products Co., 6541 Euclid Ave., Cleveland, Ohio.
Seydel: Seydel Chemical Co., 225 Mercer St., Jersey City, N.J.
Seydel-Woolley: Seydel-Woolley & Co., 748 Rice St., N.W., Atlanta, Ga.
Sharp & Dohme: Sharp & Dohme, Inc., 640 N. Broad St., Philadelphia, Pa.
Sharples: Sharples Chemicals, Inc., 123 S. Broad St., Philadelphia, Pa.
Shawinigan: Shawinigan Chemicals, Inc., 350 5th Ave., New York, N.Y.
Sheffield: Chemurgic Div., Sheffield Farms Co., Inc., 524 W. 57th St., New York, N.Y.
Shell: Chemical Div., Shell Union Oil Corp., 100 Bush St., San Francisco, Calif.
Shepherd: Shepherd Chemical Co., Norwood, Cincinnati, Ohio.
Sherman: Sherman Laboratories, 14600 E. Jefferson Ave., Detroit, Mich.
Sherwood: Sherwood Refining Co., Inc., 1 W. Forest Ave., Englewood, N.J.
Shields: Thomas J. Shields Co., 11 Water St., New York, N.Y.
Siegel: Siegel Chemical Co., 1 Hanson Pl., Brooklyn, N.Y.
Sillcocks-Miller: Sillcocks-Miller Co., South Orange, N.J.
Sillers: Sillers Paint & Varnish Co., 823 E. 61st St., Los Angeles, Calif.
Silver Oxide: Silver Oxide Products Co., Aldan, Pa.
Simonds: Simonds Saw Co., Fitchburgh, Mass.
Sinclair: Sinclair Refining Co., 630 5th Ave., New York, N.Y.
Sindar: Sindar Corporation, 330 W. 42nd St., New York, N.Y.
Sjostrom: C. V. G. Sjostrom, 121 Lyman St., Springfield, Mass.

Skelly: Skelly Oil Co., 605 W. 47th St., Kansas City, Mo.
Smith, Edward: Edward Smith Co., 11 E. 36th St., New York, N.Y.
Smith, J. Lee: J. Lee Smith & Co., Inc., 19 Jacob St., New York, N.Y.
Smith, Werner: Werner G. Smith Div., Archer, Daniels, Midland Co., 2191 W. 110th St., Cleveland, Ohio.
Snowden: Snowden Chemical Co., P.O. Box 509, Modesto, Calif.
Socony-Vacuum: Socony-Vacuum Oil Co., Inc., 26 Broadway, New York, N.Y.
Solar: Solar Products Co., 1201 W. Blanke St., Linden, N.J.
Soluol: Soluol Corporation, 225 Chapman St., Providence, R.I.
Solvay: Solvay Sales Corp., 40 Rector St., New York, N.Y.
Somerset: Somerset Color & Chemical Co., 615 E. 22nd St., Paterson, N.J.
Sommers: Sommers & Company, Ltd., 548 W. 46th St., New York, N.Y.
Sonneborn: L. Sonneborn Sons, Inc., 88 Lexington Ave., New York, N.Y.
Sonnenschein: E. Sonnenschein & Co., 276 5th Ave., New York, N.Y.
Southeastern: Southeastern Reduction Co., 902 Carolina St., Greensboro, N.C.
So. Chem. Cotton: Southern Chemical Cotton Co., Chattanooga, Tenn.
So. Cotton Oil: Southern Cotton Oil Co., 21 West St., New York, N.Y.
So. Dyestuff: Southern Dyestuff Corp., P.O. Box 1045, Charlotte, N.C.
So. Mineral: Southern Mineral Products Corp., 420 Lexington Ave., New York, N.Y.
So. Pine: Southern Pine Extract Co., 922 E. Gregory St., Pensacola, Fla.
So. Pine Chem.: Southern Pine Chemical Co., P.O. Box 389, Jacksonville, Fla.
Southeastern: Southeastern Clay Co., Aiken, S.C.
Sowa: Sowa Chemical Co., 305 E. 46th St., New York, N.Y.
Sparhawk: Sparhawk Company, P.O. Box 327, Sparkhill, N.Y.
Spazier: Spazier Soap & Chemical Co., 1619 20th St., Santa Monica, Calif.
Speare's: Alden Speare's Sons Co., Cambridge, Mass.
Spebra: Spebra Products Manufacturing Co., Inc., 1288 Troy Ave., Brooklyn, N.Y.
Spec. Mfg.: Specialty Manufacturing Co., Hoosick Falls, N.Y.
Special Chems.: Special Chemicals Corp., 30 Irving Pl., New York, N.Y.
Specialty Prods.: Specialty Products Co., Inc., 190 Warren St., Jersey City, N.J.
Spencer: Spencer Chemical Co., Dwight Bldg., Kansas City, Mo.
Spencer Kellogg: Spencer Kellogg & Sons, Inc., 98 Delaware Ave., Buffalo, N.Y.
Spirittine: Spirittine Chemical Co., 117 S. Front St., Wilmington, N.C.
Stahl: Stahl Finish Co., 23 Caller St., Peabody, Mass.
Staley: A. E. Staley Manufacturing Co., 420 Lexington Ave., New York, N.Y.
Stalwart: Stalwart Rubber Co., 160 Northfield Rd., Bedford, Ohio.
Stamford: Stamford Rubber Supply Co., Shippan Ave., Stamford, Conn.
Stand. Agric.: Standard Agricultural Chemicals, Inc., Hoboken, N.J.
Stand. Brands: Standard Brands, Inc., 595 Madison Ave., New York, N.Y.
Stand. Chem.: Standard Chemical Co., 223 E. Detroit St., Milwaukee, Wis.
Stand. Chem. Prods.: Standard Chemical Products Inc., 1301 Jefferson St., Hoboken, N.J.
Stand. Industrial: Standard Industrial Products, Inc., 1500 Park Ave., Evansville, Ind.
Stand. Oil, Calif.: Standard Oil Co. of California, 225 Bush St., San Francisco, Calif.
Stand. Oil Devel.: Standard Oil Development Co., 30 Rockefeller Plaza, New York, N.Y.
Stand. Oil, Ind.: Standard Oil Co. of Indiana, 910 S. Michigan Ave., Chicago, Ill.
Stand. Oil, N.J.: Standard Oil Co. of New Jersey, 26 Broadway, New York, N.Y.
Stand. Silicate: Standard Silicate Div., Diamond Alkali Co., 535 Smithfield St., Pittsburgh, Pa.
Stand. Ultramarine: Standard Ultramarine Co., 24th & 5th Aves., Huntington, W. Va.
Stand. Varnish: Standard Varnish Works, 2589 Richmond Terrace, Staten Island, N.Y.
Stanley: Stanley Chemical Co., East Berlin, Conn.
Stauffer: Stauffer Chemical Co., 636 California St., San Francisco, Calif.
Steadman: F. W. Steadman Co., 59 Pearl St., New York, N.Y.
Stein-Hall: Stein, Hall & Co., Inc., 285 Madison Ave., New York, N.Y.
Stephan: Stephan Chemical Co., 1353 N. Branch St., Chicago, Ill.
Sterwin: Sterwin Chemicals, Inc., 170 Varick St., New York, N.Y.
Stetson: John B. Stetson Co., 5th St. & Montgomery Ave., Philadelphia, Pa.
Stockton: Stockton Paint Co., Stockton, Calif.

Strahl & Pitsch: Strahl & Pitsch, 141 Front St., New York, N.Y.
Stresen-Reuter: Frederick A. Stresen-Reuter, Inc., 2113 Medill Ave., Chicago, Ill.
Stuart: D. A. Stuart Oil Co., Ltd., 2727 S. Troy St., Chicago, Ill.
Stuart-Brumley: Stuart-Brumley Corporation, 516 N. Charles St., Baltimore, Md.
Stull: A. J. Stull & Co., 5816 Tacony St., Philadelphia, Pa.
Sturgis: Sturgis Products Co., Sturgis, Mich.
Sucro-Blanc: Sucro-Blanc, Inc., 79 Wall St., New York, N.Y.
Sullivan: Sullivan Company, 212 E. Tregg Ave., Memphis, Tenn.
Sun Chem.: Sun Chemical Corp., 100 6th Ave., New York, N.Y.
Sun Oil: Sun Oil Co., 1608 Walnut St., Philadelphia, Pa.
Superior Phosphate: Superior Phosphate Co., Dunnellon, Fla.
Superior Prods.: Superior Products Co., 148-50 Pearl St., Sommerville, Mass.
Surpass: Surpass Chemical Co., 1254 Broadway, Albany, N.Y.
Swan-Finch: Swan-Finch Oil Co., 30 Rockefeller Plaza, New York, N.Y.
Sweets: Sweets Laboratory, Inc., 423 W. 127th St., New York, N.Y.
Sweney: W. H. Sweney & Co., 43 E. Water St., St. Paul, Minn.
Swift: Swift & Company, Union Stock Yards, Chicago, Ill.
Switzer: Switzer Brothers, 30 Church St., New York, N.Y.
Sylvania: Sylvania Div., American Viscose Co., 122 E. 42nd St., New York, N.Y.
Synfleur: Synfleur Scientific Laboratories, Monticello, N.Y.
Synthane: Synthane Corporation, Oaks, Pa.
Synthetic Chems.: Synthetic Chemicals, Inc., 335 McLean Blvd., Paterson, N.J.
Synthetic Nitrogen: Synthetic Nitrogen Products Corp., 285 Madison Ave., New York, N.Y.
Synthetic Prods.: Synthetic Products Co., 1798 London Rd., Cleveland, Ohio.
Synthron: Synthron Company, Crescent Plaza Bldg., Long Island City, N.Y.
Synvar: Synvar Corporation, 415 E. Front St., Wilmington, Del.

Takamine: Takamine Laboratory, Inc., 193 Arlington St., Clifton, N.J.
Tamm's: Tamm's Silica Co., 228 N. LaSalle St., Chicago, Ill.
Tanade: Tanade Company, 2136 Dominick St., Chicago, Ill.
Tanner: C. S. Tanner Co., 250 S. Water St., Providence, R.I.
Tater: Tater Machinery Co., Leominster, Mass.
Taylor: Taylor Chemical Works, Ltd., P.O. Box 337, Aberdeen, N.C.
Tech. Finishes: Technical Finishes Corp., 4851 St. Louis Ave., Chicago, Ill.
Tempil: Tempil Corporation, 132 W. 22nd St., New York, N.Y.
Tenn. Corp.: Tennessee Corporation, Grant Bldg., Atlanta, Ga.
Tenn. Eastman: Tennessee Eastman Corp., Kingsport, Tenn.
Tenn. Prods.: Tennessee Products & Chemical Corp., American National Bank Bldg., Nashville, Tenn.
Terry: Hungerford Terry, Inc., Clayton, N.J.
Texas Co.: Texas Company, 135 E. 42nd St., New York, N.Y.
Texas Gulf: Texas Gulf Sulphur Co., 75 E. 45th St., New York, N.Y.
Texas Mining: Texas Mining & Smelting Co., P.O. Box 559, Laredo, Tex.
Textile Prods.: Textile Products Co., 7 Spring St., Providence, R.I.
Textile Proofers: Textile Proofers, Inc., 181-193 Culver Ave., Jersey City, N.J.
Thibault: Thibault & Woker Co., Inc., 5-48 46th Rd., Long Island City, N.Y.
Thomas: Arthur H. Thomas Co., West Washington Sq., Philadelphia, Pa.
Thompson-Hayward: Thompson-Hayward Company, 2915 Southwest Blvd., Kansas City, Mo.
Thompson Hort.: Thompson Horticultural Chemicals Corp., 3600 Monon St., Los Angeles, Calif.
Thompson, Weinman: Thompson, Weinman & Co., Inc., 52 Vanderbilt Ave., New York, N.Y.
Tide Water: Tide Water Associated Oil Co., 17 Battery Pl., New York, N.Y.
Timber: Timber Engineering Co., 1319 18th St., N.W., Washington, D.C.
Titan: Titan Chemical Products, Inc., Mill Road & Wayne St., Jersey City, N.J.
Titanine: Titanine, Inc., Morris & Elmwood Aves., Union, N.J.
Titanium Alloy: Titanium Alloy Manufacturing Div., National Lead Co., 111 Broadway, New York, N.Y.

Titanium Pigment: Titanium Pigment Corp., 111 Broadway, New York, N.Y.
Tobacco: Tobacco By-Products & Chemical Corp., Columbia Bldg., Louisville, Ky.
Toch: Toch Brothers, 2589 Richmond Terrace, Staten Island, N.Y.
Tombarel: Tombarel Products Corp., 12 E. 22nd St., New York, N.Y.
Touraine: Touraine Chemical Co., 285 Madison Ave., New York, N.Y.
Trask: Arthur C. Trask Co., 4103 S. LaSalle St., Chicago, Ill.
Tremco: Tremco Manufacturing Co., 8600 Kinsman Rd., Cleveland, Ohio.
Trendex: Trendex Company, Memphis, Tenn.
Tropical: Tropical Paint & Oil Co., 1214 W. 70th St., Cleveland, Ohio.
Truscon: Truscon Laboratories, Caniff & Grand Trunk R.R., Detroit, Mich.
Tumbler: J. A. Tumbler Laboratories, Inc., 423 S. Hanover St., Baltimore, Md.
Turco: Turco Products, Inc., 6135 S. Central Ave., Los Angeles, Calif.
Turner: Joseph Turner & Co., Ridgefield, N.J.
Tyler: W. S. Tyler Co., 3615 Superior Ave., Cleveland, Ohio.
Tyson: Tyson Corporation, Woodbridge, N.J.

Ultra: Ultra Chemical Co., Inc., 500 5th Ave., New York, N.Y.
Ultra Works: Ultra Chemical Works, Inc., 2 Wood St., Paterson, N.J.
Ungerer: Ungerer & Company, 161 6th Ave., New York, N.Y.
Union Bag: Union Bag & Paper Co., 233 Broadway, New York, N.Y.
Union-Baystate: Union-Baystate Chemical Co., Inc., 50 Harvard St., Cambridge, Mass.
Union Oil: Union Oil Co., Ponce St. above Holabird Ave., Baltimore, Md.
United Aniline: United Aniline Co., 156 Pearl St., Boston, Mass.
United Carbon: United Carbon Co., Inc., Union Bldg., Charleston, W. Va.
United Chem. Prods.: United Chemical Products Corp., 753 Montgomery St., Jersey City, N.J.
United Chromium: United Chromium, Inc., 51 E. 42nd St., New York, N.Y.
United Clay: United Clay Mines Corp., Prospect & Oakland Aves., Trenton, N.J.
United Color: United Color & Pigment Div., Interchemical Corporation, Evergreen Ave., Newark, N.J.
United Distillers: United Distillers of America, 350 5th Ave., New York, N.Y.
United Finish: United Finish Co., 100 Corwin St., Peabody, Mass.
United Lacquer: United Lacquer Manufacturing Co., Linden, N.J.
United Oil: United Oil & National Gas Products Corp., Monroe, La.
United Oil Mfg.: United Oil Manufacturing Co., 1429 Walnut St., Erie, Pa.
U. S. Bronze: U. S. Bronze Powder Works, 220 W. 42nd St., New York, N.Y.
U. S. Dyestuff: U. S. Dyestuff Corp., P.O. Box 1552, Boston, Mass.
U. S. Gypsum: U. S. Gypsum Co., 300 W. Adams St., Chicago, Ill.
U. S. I.: U. S. Industrial Chemicals, Inc., 60 E. 42nd St., New York, N.Y.
U. S. Radium: U. S. Radium Corp., 535 Pearl St., New York, N.Y.
U. S. Rubber: United States Rubber Co., 1230 6th Ave., New York, N.Y.
U. S. Sand: U. S. Sand Paper Co., Williamsport, Pa.
U. S. Stoneware: U. S. Stoneware Co., Akron, Ohio.
U. S. Talc: U. S. Talc Co., 147 Nassau St., New York, N.Y.
U. S. Testing: U. S. Testing Co., Inc., 1415 Park Ave., Hoboken, N.J.

Va. Smelting: Virginia Smelting Co., West Norfolk, Va.
Valentine Co.: Valentine Company, Fourth Ave. Bldg., Seattle, Wash.
Van Allen: L. R. Van Allen & Co., 405 N. Wells St., Chicago, Ill.
Van Ameringen: Van Ameringen-Haebler, Inc., 315 4th Ave., New York, N.Y.
Van Dyk: Van Dyk & Company, Inc., 11 William St., Belleville, N.J.
Van Straaten: Van Straaten Chemical Co., 5520 Northwest Highway, Chicago, Ill.
Vanadium: Vanadium Corp. of America, 420 Lexington Ave., New York, N.Y.
Vanderbilt: R. T. Vanderbilt Co., 230 Park Ave., New York, N.Y.
Varcum: Varcum Chemical Corp., Pine & Packard Sts., Niagara Falls, N.Y.
Variton: Variton Company, 416 N. Varney St., Burbank, Calif.
Veith: Veith Chemical Co., 1261 Blackstone Ave., Fresno, Calif.
Vegetable: Vegetable Oil Products Co., 401 S. Avalon Blvd., Wilmington, Calif.
Vejin: Vejin, Inc., 944 W. 5th St., Cincinnati, Ohio.
Velsicol: Velsicol Corporation, 330 E. Grand Ave., Chicago, Ill.
Verley: Albert Verley, Inc., 1621 W. Carroll Ave., Chicago, Ill.

Verona: Verona Chemical Co., 26 Verona Ave., Newark, N.J.
Victor: Victor Chemical Works, 141 W. Jackson Blvd., Chicago, Ill.
Va.-Car.: Virginia-Carolina Chemical Corp., 401 E. Main St., Richmond, Va.
Visco: Visco Products Co., Sterling Bldg., Houston, Tex.
Viscose: American Viscose Corp., 350 5th Ave., New York, N.Y.
Vita-Var: Vita-Var Corporation, 1180 Raymond Bldg., Newark, N.J.
Vitro: Vitro Manufacturing Co., 60 Greenway Drive, Corliss Station, Pittsburgh, Pa.
Vulcanized: Vulcanized Rubber Co., 261 5th Ave., New York, N.Y.
Vulcanized Fibre: National Vulcanized Fibre Co., 100 Beach St., Wilmington, Del.
Vultex: Vultex Chemical Co., 606 Main St., Cambridge, Mass.

W-H-C: Welch, Holme, & Clark, Inc., 439 West St., New York, N.Y.
W. Va. Pulp: West Virginia Pulp & Paper Co., Industrial Chemical Sales Div., 230 Park Ave., New York, N.Y.
Wagner: Charles Wagner Co., 813 Callowhill St., Philadelphia, Pa.
Wailes: Wailes-Dove-Hermiston Div., Kopper's Company, 17 Battery Pl., New York, N.Y.
Waldo: E. M. & F. Waldo, Inc., Muirkirk, Md.
Wallace: Wallace & Tiernan, Inc., 11 Mill St., Belleville, N.J.
Wallerstein: Wallerstein Laboratories, 180 Madison Ave., New York, N.Y.
Warner Co.: Warner Company, 219 N. Broad St., Philadelphia, Pa.
Warren Soap: Warren Soap Manufacturing Co., 51 Waverly St., Boston, Mass.
Warwick: Warwick Chemical Co. Div., Sun Chemical Co., 100 High St., West Warwick, R.I.
Washine: Washine National Sands, Inc., 37-02 Northern Blvd., Long Island City, N.Y.
Washington Mills: Washington Mills Abrasive Co., North Grafton, Mass.
Watertown: Watertown Manufacturing Co., Watertown, Conn.
Watford: Watford Chemical Corp., 25 W. 41st St., New York, N.Y.
Watson-Park: Watson-Park Company, 261 Franklin St., Boston, Mass.
Watson-Stand.: Watson-Standard Co., 225 Galveston Ave., Pittsburgh, Pa.
Waverly: Waverly Oil Works Co., 54th St. & AVRR, Pittsburgh, Pa.
Wayne: Wayne Chemical Products Div., Wayne Soap Co., 911 Copeland St., Detroit, Mich.
Wells Color: Wells Color & Chemical Co., 330 W. State St., Johnstown, N.Y.
Werk: M. Werk Co., Murray Ave., St. Bernard, Cincinnati, Ohio.
Werner: R. D. Werner Co., Inc., 295 5th Ave., New York, N.Y.
West. Electrochem.: Western Electrochemical Co., 315 W. 9th St., Los Angeles, Calif.
Western Lime: Western Lime & Cement Co., 207 E. Michigan St., Milwaukee, Wis.
Western Reserve: Western Reserve Chemical Co., 1740 E. 12th St., Cleveland, Ohio.
Westinghouse: Westinghouse Electric Corp., Ardmore Blvd., East Pittsburgh, Pa.
Westvaco: Westvaco Chemical Div., Food Machinery & Chemical Corp., 405 Lexington Ave., New York, N.Y.
Westville: Westville Laboratories, Monroe, Conn.
Wetherill: S. P. Wetherill Co., 1328 Chestnut St., Philadelphia, Pa.
Weyerhaeuser: Weyerhaeuser Timber Co., Tacoma, Wash.
Wharry: G. A. Wharry & Co., Inc., 95 Broad St., New York, N.Y.
White, S. S.: S. S. White Dental Manufacturing Co., 211 S. 12th St., Philadelphia, Pa.
White & Hodges: White & Hodges, 2 Wellington Ave., Everett, Mass.
White Tar: White Tar Co., Kearny, N.J.
Whiterock: Whiterock Quarries, Inc., Bellefonte, Pa.
Whitman: Whitman Company, 1407 Esperanza St., Los Angeles, Calif.
Whitmire: Whitmire Research Corp., 539 S. Vandeventer St., St. Louis, Mo.
Whitmoyer: Whitmoyer Laboratories, Myerstown, Pa.
Whittaker: Whittaker, Clark & Daniels, Inc., 260 W. Broadway, New York, N.Y.
Whittemore-Wright: Whittemore-Wright Company, Inc., 62 Alford St., Charlestown Dist., Boston, Mass.
Wilbur & Williams: Wilbur & Williams Co., Greenleaf & Leon Sts., Boston, Mass.
Will & Baumer: Will & Baumer Candle Co., Park St., Syracuse, N.Y.
Williams, C. K.: C. K. Williams & Co., 640 N. 13th St., Easton, Pa.
Williams Chem.: Williams Chemical Co., 555 N.W. 5th St., Miami, Fla.

Wilson Carbon: Wilson Carbon Co., 60 E. 42nd St., New York, N.Y.
Winsor: Winsor & Newton, 31 Union Sq., W., New York, N.Y.
Wis. Chem.: Wisconsin Chemical Products Co., Inc., 5117-19 N. 32nd St., Milwaukee, Wis.
Wis. Found.: Wisconsin Alumni Research Foundation, Madison, Wis.
Witco: Witco Chemical Co., 295 Madison Ave., New York, N.Y.
Woburn: Woburn Chemical Corp., 1200 Harrison Ave., Harrison, N.J.
Wolf: Jacques Wolf & Co., 350 Lexington Ave., Passaic, N.J.
Wollen: Wollen Chemical & Supply Co., Waite St. & 6th Ave., Paterson, N.J.
Wood: W. A. Wood Co., 45 Purchase St., Boston, Mass.
Wood Treat.: Wood Treating Chemicals Co., 5137 Southwest Ave., St. Louis, Mo.
Woolfolk: Woolfolk Chemical Works, Ltd., Fort Valley, Ga.
Woolsey: C. A. Woolsey Paint & Color Co., Inc., 299 E. 42nd St., New York, N.Y.
Woonsocket: Woonsocket Color & Chemical Co., 92 Sunnyside Ave., Woonsocket, R.I.
Wyandotte: Wyandotte Chemicals Corp., Wyandotte, Mich.
Wyodak: Wyodak Chemical Co., 4600 E. 71st St., Cleveland, Ohio.

Xylos: Xylos Rubber Co., Akron, Ohio.

Young: Charles W. Young & Co., 1247 N. 26th St., Philadelphia, Pa.
Young Aniline: Young Aniline Works, 2701 Boston St., Baltimore, Md.

Zapon: Zapon-Keratol Div., Atlas Powder Co., Stamford, Conn.
Zeolite: Zeolite Engineering Co., Chicago, Ill.
Zeolite Chem.: Zeolite Chemical Co., 140 Cedar St., New York, N.Y.
Zialate: Zialate Corporation, 92 Grove St., Worcester, Mass.
Zibell: Zibell Damp Resisting Paint Co., 248 Front St., New York, N.Y.
Zinsser: Zinsser & Company, Inc., Railroad Ave., Hastings-on-Hudson, N.Y.
Zinsser, Wm.: William Zinsser & Co., 516 W. 59th St., New York, N.Y.
Zobel: Ernest Zobel Co., 2nd Ave. & 10th St., Brooklyn, N.Y.
Zophar: Zophar Mills, Inc., 116 26th St., Brooklyn, N.Y.
Zurn: O. F. Zurn Co., 2736-40 N. Broad St., Philadelphia, Pa.

TRADE NAMES

A

A (Ansbacher): series of paint and varnish pigments.
A-000 (Gen. Mills): uncompounded polyamide resin suspensoid; heat sealing compound.
A-1 (Monsanto): thiocarbanilide; rubber accelerator.
A-2-Z (Planetary): proprietary emulsifying agent.
A-10 (Monsanto): condensation product of aniline and formaldehyde; rubber accelerator.
A-11 (Monsanto): formaldehyde derivative of condensation product of aniline and acetaldehyde; rubber accelerator.
A-19 (Monsanto): formaldehyde derivative of a condensation product of aniline and acetaldehyde; rubber accelerator.
A-22 (Gen. Mills): modified wheat starch; edible thickener and stabilizer.
A-32 (Monsanto): product of butyraldehyde and butylidene aniline; rubber accelerator.
A-46 (Monsanto): constant composition blend of Santocure (Monsanto) and El Sixty (Monsanto); rubber accelerator.
A-77 (Monsanto): condensation product of acetaldehyde and aniline; rubber accelerator.
A-100 (Monsanto): aldehyde derivative of a Schiff's base; rubber accelerator.
A-5175 (Linde): aluminum oxide in form of hexagonal crystals; abrasive, in manufacture of phosphors, catalyst carrier.
A acid: 1,7-dihydroxynaphthalene-3,6-disulfonic acid; dye intermediate.
A-Resin (Stand. Oil, N.J.): petroleum-derivative synthetic resin; coatings formulations.
A Syrup (Phila. Quartz): sodium silicate for papermaking.
A A (Baker): castor oil.
AA (Eagle-Picher): mixture of zinc oxide and leaded zinc oxide; paint pigment.
AA-6 (Binney & Smith): carbon black.
AA Acid (Alox): proprietary rubber accelerator.
AA Mica (Thompson-Weiman): ground stearic mica; pigment.
AA Needle Oil (Zurn): needle lubricant.
AA Oil (Natl. Rosin): rosin-oil saturating agent for canvas belting.
A.A. Spirits (Turco): base for turpentine substitute.
AA Waxes (Allied Asphalt): series modified and compounded natural and synthetic waxes.
AAA (Eagle-Picher): orange mineral.
AAAA (J. Lee Smith): Venetian red.
A.A.O. (du Pont): zinc and sodium cyanides with caustic soda and other ingredients; zinc-plating bath; Zin-O-Lyte.
AC - 4 (Monsanto): catalyst for resin polymerization in urea and melamine treatment of fabrics.
A.C.E. (du Pont): asphalt chromate emulsion; protective coating for wood and metal.
AD-21 (Velsicol): hydrocarbon base synthetic resin; baking enamel formulations.
ADD (Sonneborn): proprietary fly-spray base.
ADP.: PN, q.v.
AE-1 (Monsanto): an alcohol ester; intermediate, solvent, and plasticizer.
AEA (Dewey & Almy): air-entraining agent for concretes.
A.E.S.A. (Goodrich): 2-aminoethyl sulfuric acid; amineoethylating agent, source of ethylene imine, water-repellent for paper and textiles.
AFB (Naugatuck Chem.): proprietary rubber antiscorch.
A.F.P.T. (du Pont): anhydrous formadehyde-p-toluidine; rubber accelerator; Akbar.
AG Black Wax (Steadman): synthetic wax; montan wax substitute and extender.
AGF (Soluol): textile lubricant and penetrant.
A.M. Base (Quaker): cutting coolant for aluminum sand castings, zinc and aluminum die castings, soft metal alloys.
AMP: adenosine-5-phosphoric acid.
A-M-P (Stand. Oil, Calif.): series of various high melting point waxes.
A.N.L. (Barrett): pelleted ammonium nitrate-limestone mixture (20.5%

Finishing Compound WP (Bick): proprietary textile disinfecting finishing compound.
Finishing Gum (Wolf): mixture of carbohydrates and proteins; textile finishing compound.
Finishing Gum 51 (Am. Aniline): gum binder for starching.
Finishing Gum X (Wolf): various compounds of starches and natural gums; textile finishes.
Finishing Oil 50-S (Bryant): highly sulfated vegetable base; textile softening, lubricating agent.
Finishing Oil 112 (Burkart): sulfonated vegetable oils; textile softening and finishing agent.
Finol (Agfa): various photographic chemicals.
Fioramore B.M. (Polak's): compounded perfume-base for toilet goods, soap, etc.
Firco (Gen. Plastics): resin used for impregnating fibrous products.
fire damp: methane.
Fire-Foe (Price): wood fireproofing compound.
Fire Proofing Agent DJ (Woonsocket): proprietary flame-proofing agent.
Fire Red Toner (Zinsser): dry color; pigment.
Fire Refined (Lucas): white lead and zinc; pigments.
Firecide (Snowden): fire extinguishing compound.
Firepel (Alembik): proprietary flame-proofing compound.
Fireproof Powder Dyset (Apex): proprietary flame-proofing compound.
Firm Welt (Cataract): series of leather dyes.
Firmol (Houghton): silk degumming agent.
Firmtex (Royce): proprietary finishing compound for rayons.
First Suds (Milwaukee Lub.): wire-drawing soap.
Firstoline (Am. Firstoline): proprietary corrosion and rust preventive.
Firstopone (Am. Firstoline): zinc pigment.
Fischer's yellow: cobalt potassium nitrite; pigment.
fish-and-potash salts: mixture of fish scrap and potash salts; fertilizer ingredient.
Five O'Clock (Chiris): floral scent perfume base.
Fixacol (Ciba): quaternary ammonium compound; cation-active dye bath additive; fixing agent for basic and direct dyes.
Fixalt (Monsanto): mordant for dying cotton and wool.
Fixanal (Pfaltz & Bauer): series of normal solutions.
Fixapret (Gen. Dyes.): textile finishing agent.
Fixarome (Roure-Dupont): perfume fixative.
Fixaromes (Beiser): various perfume fixatives.
Fixateur E.C. (Seebach): perfume fixative for eau de cologne.
Fixateur F.B. (Seebach): perfume fixative for fancy odors.
Fixateur F.O. (Seebach): perfume fixative for flower odors.
Fixateur L. (Seebach): perfume fixative for lavender.
Fixateur O.B. (Seebach): perfume fixative for oriental odors.
Fixateur Resin (Gen. Drug): perfume fixative.
Fixateur Special (Roure-Dupont): perfume fixative.
Fixateur TPC (Tombrel): perfume fixative.
fixed air: carbon monoxide.
fixed nitre: potassium carbonate.
fixed oil: fatty oil, q.v.
fixin: annatto, q.v.
Fixing Salt (Nyanza): proprietary aftertreating agent for textile dyeing.
Fixing Salt (United Chem. Prods.): compound of inorganic salts; dye aftertreating agent.
Fixing Salts (Durfee): preparation for making union dyes water fast.
Fixiol 116 (Roure-Dupont): odor base for perfumes.
Fixo-Lavande (Firmenich): fixative for lavender-scent colognes.
Fixo-Mousse 2904 (Firmenich): fixative for chypre type perfumes.
Fixo-Musc 2737 (Firmenich): fixative with an animal note for perfumes.
Fixo-Resine 2233 (Firmenich): fixative of balsamic tone; for lotions and eaux-de-cologne.
Fixodors (D & O): series of aromatic bases and fixatives.
Fixol (van Amerigen): hydroxy-citronellal; perfume fixative.
Fixtan B (du Pont): tanning chemicals in a gelatinous substance; filler and color stabilizer for heavy leathers.
flake white: 1-best grade of white lead. 2-bismuth subnitrate.
Flakolein (Draper): wool scouring soap.
Flame Proof B (Car. Aniline): partially saponified fats; flameproofing agent for fabrics.
Flamenol (G.E.): vinyl chloride resin.
Flameproof F.T. (Titan): proprietary flame-proofing agent.
Flameproofing Agent 313 (Glyco): proprietary flame-proofing agent for textiles and paper.
Flamex (Diversey): flame-proofing agent for fabrics.
Flamort (Flamort): series of fire-retardant chemicals.

Flash (Turco): proprietary cleaning agent for pasteurizing machines.
Flashon (Gen. Chem.): fluxing compound.
Flatex (Toch): series of paint pigments.
Flatwrap (Paisley): tightwrap glue for set-up boxes.
flavan: flavanone, q.v.
flavanol: 3-hydroxyflavone; vegetable dye.
flavanone: 2,3-dihydro-2-phenyl-1,4-benzonyrone; yellow dye for silk and wool.
flavazine: sodium salt of 1-p-sulfopbenyl methyl-4-phenyl-diazonium-5-pyrazolone; yellow acid dye.
Flavazine (Gen. Dyes.): acid coal-tar dyes dyeing yellows.
flavianic acid: 2,4-dinitro-1-naphthol-7-sulfonic acid; intermediate.
flavin: tetrahydroxyflavanol; yellow dye from black oak bark.
flavinduline: 9-phenyldibenzophenazonium; yellow dye.
flavol: flavanol, q.v.
flavophenine: yellow azo dye.
flavopurin: 1,2,6-trihydroxyanthraquinone; yellow dye.
flavopurpurin: red, mordant dye for cotton.
Flavorbase (Chiris): synthetic flavor compound.
Flectol (Monsanto): series of condensation products of acetone and aniline; rubber accelerators and antioxidants.
Flectol White (Monsanto): argyl oxy-ketone; rubber antioxidant.
Fleur d'Oranger, V-C (Ungerer): compounded perfume base.
Fleurolia (Fritzsche): floral scent; perfume base.
Fleuronal (Polak's): series of compounded perfume bases for toilet goods, soap, etc.
Fleurone (Synfleur): series of floral toning agents for perfumes and cosmetics.
Fleurs de Cerisier (Seebach): synthetic perfume oil for perfumes, lotions, etc.
Fleurs de Cerisier O.S. (Seebach): oil-soluble perfume oil for brilliantines, etc.
Fleurs d'Oranger 1401 (Givaudan): floral odor perfume base.
Fleurs Variees (Polak's): series of compounded perfume bases for toilet goods, soap, etc.
Flex-B (Amecco): non-volatile hydrocarbon derivative; rubber plascizer.
Flex-O-Kalk (Ruehl): carburizing compound.
Flex-Synol (Am. Alkyd): synthetic drying oil.
Flex-Tex (Roxalin): printing lacquer for textiles.
Flexal (Hart Prods.): series of thermoplastic resins; resin finishes for fabrics.
Flexalyn (Hercules): diethylene glycol ester of rosin; tacky semi-liquid resin.
Flexalyn C (Hercules): ethylene glycol ester of rosin; tacky, brittle, solid resin.
Flexbond (Special Chemicals): emulsified polyvinyl acetate; liquid adhesive.
Flexflat (Paisley): non-warping flexible adhesive.
Flexible Pyrex (Victor): flame-proofing agent for paper.
Flexiflat (Paisley): non-warp paste.
Flexin (Aktivin): self-emulsifying lecithin; textile softening agent.
Flexo 509 (Aktivin): lecithin solution; softening and plasticizing agent.
Flexo Wax (Glyco): synthetic hydrocarbon wax; screen-printing textiles, in polishes and buffing compounds, adhesive for cellulose acetate film.
Flexo Wax C Light (Glyco): cello-phane-to-paper adhesive.
Flexoid (Sillers): liquid rubber dressing.
Flexol (CCC): tri(2-chloroethyl) phosphate; flame-resistant plasticizer.
Flexol 3GH (CCC): triethylene glycol di-2-ethylbutyrate; plasticizer for vinyl-butyral resins.
Flexol 3GO (CCC): triethylene glycol di-2-ethylhexoate; plasticizer for adhesive resins and synthetic rubbers.
Flexol 8HP (CCC): di-2-ethylhexyl tetrahydrophthalate; plasticizer.
Flexol DHP (CCC): di-n-hexyl phthalate; auxiliary plasticizer for vinyl resins.
Flexol DOP (CCC): di-2-ethylhexyl phthalate; plasticizer for resins.
Flexol Plasticizer TOF (CCC): trioctyl phosphate; plasticizer and antifoaming agent.
Flexol TOF (CCC): tri-2-ethylhexyl phosphate; plasticizer.
Flexolite (Royce): synthetic resin for warp-sizing.
Flexon (Stand. Oil, N.J.): series of raw or partly prepared hydrocarbon materials.
Flexoresin (Glyco): polymerized terpenes; paint and adhesive formulations.
Flexowaxes (Boler): series of paraffin wax formulations for waxcoating paper.
Flexrite (Cataract): leather softener.
Flextack (Paisley): flexible glue.

Panaflex (Pan. Am.): series of hydrocarbon-base plasticizers for vinyl and synthetic elastomer compounding.
Panaflex BN (Pan Am.): high-boiling, polyaromatic, synthetic hydrocarbon oil; plasticizer for vinyls and GR-A elastormers.
Panaflex BN-1 (Pan Am.): petroleum-derived, hydrocarbon plasticizer for vinyl resins and synthetic rubbers.
Panapol (Pan Am.): series of synthetic, hydrocarbon-base, drying oils; paint vehicles and thinners.
Panarez (Pan Am.): series of thermoplastic, hydrocarbon-base resins.
panclastite: nitrogen tetraoxide dissolved in carbon bisulfide; explosive.
Pancreatin (Wolf): purified pancreatic extract; medicinals and foodstuffs.
Pannetier green: Paris green, q.v.
Panopol 2C (Pan Am.): petroleum-base, drying resin for coatings formulations.
Panplastic (Am. Plastics): synthetic phenolic plastic.
Pansy (Natl. Aniline): blend of certified food colors, violet shade.
Pantopaque (Kodak): contrast medium for radiography.
Paper Resin 601 (Am. Cyanamid): amino-aldehyde compound; paper sizing compound.
Paper Resin 607 (Am. Cyanamid): melamine-formaldehyde resin; paper impregnating compound to increase dry and wet strength.
Paper White (Gen. Dyes.): aminoarylurea sulfonate derivative; fluorescent whitening agent.
papermakers' alum: aluminum sulfate.
Papertone (Dennis): coating for preserving paper.
Paquerette (Firmenich): balsamic odor; perfume base.
Par (Vanderbilt): rubber-compounding clay.
Par-X-Lin (GG): proprietary paint oils.
para: direct, coal-tar colors aftertreated with nitrazol.
Para (Niagara Alkali): p-dichlorobenzene.
Para-Baco (Solvay): p-dichlorobenzene.
Para-Dora (Givaudan): deodorant for p-dichlorobenzene.
Para-Flux (C. P. Hall): plasticizer and flexing material for rubber and synthetic rubbers.
Para Lene (C.P. Hall): blend of various petroleum hydrocarbons; softener for GR-S synthetic rubber.
Para Lene-W (C.P. Hall): similar to Para Lene for light-colored stocks.
Para Lube (C.P. Hall): rubber softener and mold lubricant.
Para Oil (Wolf): saponified oil; dispersing agent for use with β-naphthol and other naphthol colors.
para red: a p-nitraniline, developed dye for cotton and in pigments.
Para Resins (C.P. Hall): series of semi-solid and solid, highly aromatic hydrocarbon resins; extenders and plasticizers for synthetic rubbers.
Para Scalecide (Pratt): p-dichlorobenzene and Scalecide; to control boring insects on trees.
Para-Sol (Burkart): emulsified, paraffin wax; wax finish for fabrics.
paracasein: casein digested with rennet.
Parachemogin (Chemo Puro): water-soluble, phenol derivative; preservative for glues, starches, and other organic substances.
Paracide (Hooker): p-dichlorobenzene.
Paracols (Hercules): series of water-dispersible wax emulsions; paper coatings.
Paradene (Neville): series of dark-colored paracoumarone-indene resins.
Paradi (Hooker): p-dichlorobenzene.
Paradise (Chiris): perfume base.
Paradol A (Benj. French): compounded oil for perfume extracts.
Paradors (Sindar): series of masking-odors for latex and rubber products.
Paradow (Dow): p-dichlorobenzene.
Paradura (Neville): phenolic synthetic plastics.
Paradura (Paramet): synthetic resin.
Paradyefume Oriental (N.B.W.): scent screen for p-dichlorobenzene.
paraffin ointment: petrolatum.
paraffin scale: crude paraffin wax.
Paraflow (Stand. Oil Devel.): pour-point depressant, additive for lubricants.
Paraflux (C.P. Hall): rubber softener.
paraform: p-formaldehyde.
Parafumes (Aromatic): deodorant for p-dichlorobenzene sanitary blocks.
Paragene (Eaton): textile solvent and bleach.

Paragon (Ansbacher): series of red dry colors.
Paragon (Huber): air-floated, hydrous, aluminum-silicate clay; filler in paper, compounding natural and synthetic rubbers.
Paragon (Kohnstamm): series of food flavors.
Paraguay indigo: color from Eupatorium; blue dye.
Paragutta (Bell Tel.): latex compound.
Parakeet (Sterwin): series of certified F.D. & C. food colors.
Paralketone Base B (Alox): oxygenated hydrocarbons; film-forming corrosion inhibitor.
Paralodion (Mallinckrodt): pyroxylin solution.
param: cyanoguanadene.
Paramet (Paramet): series of modified varnish gums.
Paramet Gum (Paramet): synthetic resin.
Paramine (Arkansas): proprietary textile softener.
Paramul (Am. Cyanamid): textile water repellent.
Paranilla (Kohnstamm): synthetic vanilla flavor.
Paranite (Larkin): tanning extract.
paranitraniline red: developed dye for cotton and in pigments.
Paranol (Nyanza): series of direct, coal-tar dyes for cotton.
Paranol (Paramet): modified, phenol-formaldehyde resin.
Paranol Repellent (U.S. Dyestuff): textile waterproofing agent.
Parapastels (Fritzsche): series of combined perfumes and colors for use in p-dichlorobenzene and naphthalene.
Parapel NBN (Alrose): wax emulsion; water repellent for acetate rayon fabrics.
Parapen (Paramet): various synthetic resin compositions.
Paraplex (Resinous): alkyd-type resins, dissolved in toluene; elastomer, plasticizer, coating, and impregnating compound.
Paraplex G-60 (Rohm & Haas): polyester plasticizer and stabilizer for vinyl compounds.
Paraplex P-43HV (Rohm & Haas): polyester of P-43; laminating resin.
Parapon (Arkansas): sulfonated fatty ester; textile softener, dyeing and sanforizing assistant, desizing agent.
Parapon P. (Arkansas): woolfinishing compound.
Parapon R (Arkansas): proprietary textile softener.
Parapon SA (Arkansas): vat-printing assistant.
Parapont (du Pont): p-dichlorobenzene.
Paraqua (Beacon): self-emulsifiable paraffin wax.
Paraseal (Socony-Vacuum): petroleum wax.
Parasene (Amalgamated): sulphonated oil-solvent compound; color-levelling agent.
Parasepts (Heyden): series of various p-hydroxybenzonates.
Parasheen (Stand. Oil Devel.): dye for oils.
Parasolv (Crosby): terpene-base solvent.
Paraspread (Glyco): proprietary waxy solid; plasticizer and spreading agent for paraffin and microcrystalline waxes.
Paratac (Stand. Oil Devel.): viscosity improver for lubricating oils.
Paratan (Ritter): tanstuff.
Paratex (Arkansas): neutral polyphosphate solution; water-softening and dispersing agent for lime soap.
Paratex (Beacon): waterproofing paraffin emulsion.
parathion: O,O-diethyl-p-nitrophenyl-thiophosphate insecticide.
Paratints (Givaudan): series of colored perfume oils for naphthalene and p-dichlorobenzene cyrstals and blocks.
Paratol (Seydel): textile dye-fixing agent.
Paratone (Stand. Oil Devel.): viscosity improver for lubricating oils.
para toner: p-nitraniline red: dye.
Paraturf 177 (Gallowhur): phenylamino cadmium dilactate; fungicide.
Parawax (Socony-Vacuum): paraffin wax.
Parazene (Paramet): various resinous products.
Parazone (du Pont): p-phenylphenol; rubber-aging, anti-oxident compound.
Parclay (Vanderbilt): pulverized kaolin; filler for rubber, carrier or diluent for insecticides and fungicides.
Parez (Am. Cyanamid): melamine-formaldehyde resin powder; to increase wet strength of paper.
Parfax (Hutter): penetrant and solvent for industrial use.
Parfume de Ciro (D & O): synthetic, honeycomb fragrance; perfume base.
Parical (Gen. Chem.): Paris green-calcium arsenate combination; insecticide dust.
Pariflux (Foote): calcium fluoride for welding.
Paris (Binney & Smith): series of carbon blocks from natural gas by channel process.
Paris black: lamp black.

Vinsol Ester Gums (Hercules): series of neutral glycerol esters of Vinsol.
Vinta (Natl. Aniline): blend of certified food colors, wine shade.
Vinycol (Osborn): various pigments dispersed in resins.
Vinyl 14 (Am. Resinous): series of vinyl-type latex replacements; impregnating or coating compounds for fabric or paper.
Vinyl Adhesive 848-16D (Am. Resinous): adhesive for vinyl film to itself, leather, and fabric.
Vinyl Butyral (Monsanto): series of polyvinyl-butyral, elastomeric plastics; waterproof coating, for fabrics.
Vinyl Copolymer Emulsion V9-8 (Am. Resinous): emulsion of plasticized, copolymer, vinylchloride base; fabric coating and impregnating compound.
Vinyl Plasticizer Emulsion V9-3 (Am. Resinous): plasticizer for polyvinyl-acetate aqueous dispersions.
Vinyl Resin Stabilizer #3 (Advance Solvents): organic, tin compound polymer; heat and light stabilizer for polyvinyl resins.
Vinyl Resin Stabilizer #21 (Advance Solvents): cadmium-type stabilizer for synthetic resins.
Vinyl Resin Stabilizer #52 (Advance Solvents): tin-organic polymer.
Vinyl Resin Stabilizer E6B (Advance Solvents): non-metallic stabilizer; peptizing agent to synergize their activity.
Vinylite (CCC): series of copolymers of vinyl chloride; synthetic resins and plastics.
Vinylol (Am. Resinous): various Vinylite resins; adhesive coatings, grease proofing compound, base coat for imitation leather, etc.
Vinylseal (CCC): polyvinyl acetate- solvent mixtures; adhesive.
Vinyon (CCC): vinyl chloride-vinyl acetate copolymer; synthetic fiber.
Vinyon N (CCC); vinyl chloride-acrylonitrile copolymer; synthetic fiber.
Vinysols (Am. Resinous): series of vinyl dispersions; coating for cloth or paper.
Vio-Tone (Fritzsche): series of aromatic adaptations of the ionone group; violet-scent for cosmetic formulations.
Vioflora, V-C (Ungerer): violet-orris scent; perfume base.
Violae, V-C (Ungerer): violet scent; perfume base.
violamine: various acid, coal-tar dyes.
violamine B: acid violet, q.v.; dye.
violamine G: acid rosamine, q.v.; dye.
violamine R: acid violet, q.v.; dye.
violanthrole: dibenzanthrole; purple dye for cotton.
violanthrone: dibenzanthrone; dye intermediate.
Violet 6 BN (Calco): basic, coal-tar dye.
Violet 1200 (Givaudan): synthetic floral odor perfume base.
Violet De Parme P. (Seebach): synthetic perfume oil for perfumes, lotions, etc.
Violet Parme 1187 (Seebach): synthetic perfume oil for perfumes, lotions, etc.
violet toner: methyl violet dry color.
Violettal 2905 (Firmenich): violet scent; perfume base.
violette: violet (Fr.); descriptive term used in perfumery and cosmetics.
Violette P.R.A. (Roure-Dupont): perfume concentrate for powders and creams.
Violettones (Firmenich): series of ionones; artificial violet scents for perfumes and cosmetics.
Violia-S (Synfleur): violet-jasmine-type odor base for perfumes.
virgin metal: primary metal.
Virginia Hydrosulphite (Va. Smelting): sodium hydrosulfite.
Virgo Salt (Hooker): caustic soda with oxidizing agents and catalysts; descaling agent for nonferrous metals.
Virgona, V-C (Ungerer): semi-oriental composition odor; perfume base.
Viridia (Fritzsche): synthetic perfume base.
viridian: Guignet's green, q.v.
Viridine (Givaudan): phenyl acetaldehyde dimethyl acetal; synthetic aromatic chemical, strong green-lead odor.
Virolia, V-C (Ungerer): violet and orris scent; perfume base.
Viscareen (Algin): sodium carragheenate.
Visco (Baroid): de-emulsifying agent.
Visco (Sandoz): series of direct, coal-tar dyes.
Visco (Visco): emulsion breaker.
Visco Gel (Bloede): paper-sizing compound.
Visco Gum (Quaker): textile stiffener.
Visco Gum E (Wolf): proprietary gum for wave-set hair lotions.

Visco VS (Visco): high-flash-point, petroleum solvent for oils, waxes, greases, etc.
Viscoform (Sandoz): series of direct, formaldehyde, coal-tar dyes.
Viscoil (Victor): leather-dressing compound.
Viscolan (Sandoz): series of union, coal-tar dyes.
Viscolite (Bloede): textile size.
viscose: regenerated cellulose (xanthrate) fiber; rayon.
Viscose (Gen. Dyes.): series of direct, coal-tar dyes.
Viscosene (Soluol): textile wetting agent.
Viscosene S (Soluol): textile boil-off assistant.
Viscosine (Borne Scrymser): mineral oil emulsion; fiber lubricant.
Vishnu (Chiris): perfume base.
Viskoplus (Advance Solvents): viscosity improver for oils.
Vispronal (Advance Solvents): synthetic, polymerization product; synthetic resin.
Vistac (Advance Solvents): series of non-oxidizing plasticizers for gums, waxes, rubber, etc.
Vistanex (Stand. Oil, N.J.): series of polymers of isobutylene; anti-oxidizing agent for natural rubber.
Vita Stain (Arapahoe): 2,3,5-triphenyltetrazolium chloride; stain for living tissue; test of germinability of seeds.
vital air: oxygen.
Vitaflor (Felton): fly-spray perfume.
Vitasol (Campbell): various pine-oil derivatives; dyeing assistants.
Vitasol FF (Campbell): red-oil derivative; fulling agent and assistant.
Vitatone (Miller): a-naphthalen-acetic acid; plant-growth regulator.
Vitoloil (Pittsburgh Plate Glass): processed vegetable oil; paint formulations.
vitriall: vitriol; any glistening, crystalline body (alchem.).
vitriol red: iron oxide, red.
vitriolate of lead: lead sulfate, basic.
vitrite: cyanogen chloride.
Vitro (Sartorius): series of ceramic colors.
Vitrocod (Salem): fat liquor for tanning.
Vitrol (Schreiber): animal feed supplement containing vitamins and proteins.
Vitrolan (Sandoz): series of metallized, acid, coal-tar dyes.
vitrolate of soda: sodium sulfate.
vitrolate of tartar: potassium sulfate.
vitrolated magnesia: magnesium sulfate.
vitrolated tartar: potassium sulfate.
Vitroseal (Whitman): semiglazed, refractory coating.
Vivoid (Estes): smalt.
Vix-ene (Everett & Barron): waterproofing compound for leather.
Vodol (W-B-C): edible, phosphatide derived from corn oil; stabilizer for oil-in-water emulsions, oxidation inhibitor for oils and fats.
Voile Finish (Stand. Chem. Prods.): textile stiffener.
Volan (du Pont): methacrylate chromic chloride; adhesive additive and improver.
volatile alkali: ammonia.
volatile oil: an essential oil.
Volcanic Vermilion (Pittsburgh): dry color.
Volcano (Industrial Chem.): black pigment.
Volcano (W. Va. Pulp): carbon black.
Volck (Calif. Spray): insecticide oil spray and spray carrier.
Volclay (Am. Colloid): bentonite clay; emulsion stabilizer, to increase plasticity of pottery clay, bonding agent.
Volite (Rhodes): low-lime-content volcanic ash; natural abrasive.
Voltex (United Carbon): channel carbon black for rubber compounding.
Volubilis (Tombarel): compounded perfume base.
vomiting gas: chlorpicrin.
Vopcolene (Vegetable Oil Prods.): series of fatty acids and oil specialties.
Vorite (Pierce): processed, vegetable-oil product; rubber substitute, extender, plasticizer.
Vortex Oil (Shell): blends of various petroleum oils with emulsion base; fiber lubricants for wool, shoddy, and jute.
Vuepak (Monsanto): cellulose acetate in sheets; packaging material.
Vulca (Natl. Starch): series of non-swelling, non-gelatinizing starches.
Vulcalock G (Goodrich): thermoplastic cement; rubber-to-metals adhesive.
Vulcan (Gen. Dyes.): series of rubber colors.
Vulcan (Martin): lamp and gas black.
Vulcan (Pierce): vermilion; pigment.
Vulcan 3 (Cabot): high-abrasion furnace black; rubber compounding.

Made in NEW JERSEY

Made in NEW JERSEY

The Industrial Story of a State

JOHN T. CUNNINGHAM

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MANUFACTURED IN THE UNITED STATES OF AMERICA

For DOROTHY B. CUNNINGHAM

FOREWORD

Made In New Jersey appeared first as a 31-part series in *The Newark Sunday News Magazine,* and its publication marked another step in the continuing interest in the State of New Jersey on the part of Richard B. Scudder, publisher, and Lloyd M. Felmly, editor, of *The News.*

Made In New Jersey is a companion volume to *This Is New Jersey,* the story of the state's twenty-one counties, published in 1953. Like the material in this book, the chapters in *This Is New Jersey* were published first in *The News.*

The two series which have now been converted into books are part of the continued publication by *The News* of authentic and well-written series on New Jersey's heritage. This policy of pausing to survey the past has led *The News* through continued chapters on the state's Indians, inventors and governors; sketches of old Newark; the development of railroading in New Jersey; and interesting places for summer motorists to explore.

The News has reaped many honors for these series, winning major awards from the State of New Jersey and the American Association for State and Local History. The work, unique in newspaper circles, has earned *The News* the high regard of a wide circle of teachers, historians and others concerned with telling the story of a great state.

PREFACE

Made In New Jersey is a label to tie on huge machines, sleek battleships and gleaming automobiles; to stamp on cans of paint, containers of vitamins and cans of soup; to affix to delicate dolls, plastic toys and roaring airplane motors; to print on rolls of paper, bright bread wrappers and frozen food containers. It's a summing up of the amazingly diversified industrial production of the nation's fourth smallest state, whose annual production of $5,000,000,000 worth of finished goods ranks New Jersey seventh nationally in industrial manufacture.

Few people have to be told that New Jersey is an industrial state, of course; sight and sound and smell proclaim that fact to even the most casual rider on a cross-state Pennsylvania Railroad train or to even the most absorbed driver on the New Jersey Turnpike. Yet even within the bounds of the state most people know little of the varied nature of New Jersey production, mainly because *Made In New Jersey* is a label seldom used to identify the outpourings of the state's 11,000 manufacturing plants.

This book seeks to help rectify that oversight, to cull from bewildering statistics and scattered facts a simple and direct story of the rise and development of New Jersey's fabulous industrial might. No claim to completeness is made; obviously one book can present only a broad picture, leaving the minute details to be touched in by others—perhaps by the industries themselves.

Obviously, too, no single book could tell the role of each one of New Jersey's 11,000 industries. Even a mere listing by name and address is far out of the question. Rather, the emphasis is on telling the general story of thirty broad categories of industry, in all of which New Jersey has had, and continues to have, great importance.

Nearly a year of intensive study and research went into the gathering and classifying of facts in *Made In New Jersey*. The writer visited more than 150 individual firms in every area of the state, and took full opportunity to witness at first hand the production of everything from automobiles to petroleum, from raw plastics to toys, from beer bottles to beer. This close look at such varied production, possibly never before taken by any one writer in New Jersey, fixed firmly in mind the awareness of the state's tremendous industrial potential.

Several themes are offered in *Made In New Jersey*. Chief emphasis is on the factors affecting the development of industry through the years, on showing that today's industry is the culmination of decades of work and struggle. The principal theme, therefore, is: What is New Jersey industry, and why is it great?

A major underlying theme tells the parts played by individuals in shaping the industrial pattern of both state and nation. Time after time these pages tell the saga of individuals who persisted in the face of great personal difficulties and in the face of ridicule, and in the end founded and nurtured enterprises which have grown into world-wide importance.

Then there is the theme of New Jersey's industrial development set against the background of all industrial history, so that *Made In New Jersey*, while written to tell the specific story of industrial growth within one state, in effect tells the general story of all industrial growth.

Finally, a theme has been threaded into these pages to show that while industry is important to New Jersey, so is New Jersey important to industry. The vital markets, the unexcelled transportation, the vast pools of skilled workers—all found in and near New Jersey—make it certain that industry must continue to seek out the state. New Jersey need not apologize to industry, need not feel overwhelmed that industry looks with favor upon the state. Instead, New Jersey can have the certain knowledge and buoying pride that no state is better suited for industry. If New Jersey owes much to industry—and it does—industry, in turn, owes much to New Jersey.

Often, in preparing this material, the writer felt that industry in general is not fully aware of the exciting and vital story it has to tell. Many industries find it difficult, if not impossible, to delineate quickly and clearly their early beginnings. Many know little of exact names of founders, of early struggles and early successes. A few industries even scoff at early beginnings, preferring to emphasize only the production of the moment. Fortunately, though, there is a growing awareness on the part of broad segments of industry that today's annual report is of far less interest to the average non-stockholder than the romantic story of yesterday's founder struggling to gain a foothold in the industrial world.

The thought persists, too, in this writer's mind that industry might well concern itself with telling its story in general terms—in terms of industry-wide statistics, history, and modern achievements. Statistics are particularly difficult to dig out, and will become increasingly so now that the Census of Manufactures has become a casualty of an economy-minded Congress. The last such Census was prepared in 1947 and a clear picture, unquestionably altered by the Korean War, is now exceedingly hard to get. Elimination or curtailment of the Census of Manufactures is distressing to students of current economics and will be a source of dismay for future historians.

Thus, the writer found difficulties in gathering the material for *Made In New Jersey*, but there is a growing awareness on the part of all industry that it must tell its full story—past and present—in vigorous and impartial fashion. The hope is that this book may help point the way.

It is evident that a book embracing the scope of *Made In New Jersey* needed the help of countless numbers of people in planning and researching the material. Unfortunately space permits thanking only those most intimately connected with the work.

Above all, my thanks go to many colleagues on *The Newark News*, and my chief thanks go to Lloyd M. Felmly, editor of *The News*. First my thanks are extended to Mr. Felmly for the opportunity to research and write the material for its initial appearance as a weekly series in *The Sunday News Magazine*, and secondly, for permission to re-use the basic material in this book.

Other *News* personnel helped in planning and preparing the text, including Robert T. Taylor, Edwin S. Hipp, and Joseph Taddeo. A great deal of help in researching the material came from Albert R. Hunt, Alexander Orr, and Stanley Grupy of *The News's* file room. To Mr. Grupy I also extend thanks for his preparation of the index.

Naturally the author is indebted to *The News's* photographic department, particularly to its head, Albert Beissert, and to the many photographers who took scores of pictures especially for the series.

Industrial leaders and public relations men cooperated willingly in the preparing of *Made In New Jersey*, and to them I acknowledge my debt. It is my regret that I cannot recognize each of them individually, yet that is impossible, since I talked to nearly 200 industrial personages in the course of the work. My thanks to them is sincere, for their time, their interest, their information and for pictures.

In any project in which hundreds of people helped, the difficulty—and the danger—is in singling out a few for special attention. Still, there are a few individuals who aided me materially throughout the series, and these should be recognized.

Foremost of these are Arlene R. Sayre, Gladys Ellsworth and Albert R. Post of the New Jersey Department of Conservation and Economic Development; Miriam Studley, New Jersey librarian at Newark Public Library; Marius Scopton of American Cyanamid Company; Admiral Harold G. Bowen, Paul Busse, Norman Spieden and Kathleen O. Blank of the Thomas Alva Edison Foundation; Edgar Gemmell of E. I. du Pont de Nemours Company; Clayton Cronkright and Grove Thompson of Public Service Electric & Gas Company; and Frank Townsend of New Jersey Bell Telephone Company.

Acknowledgment for special help is also due Marion Copcutt Manning, who typed the manuscript.

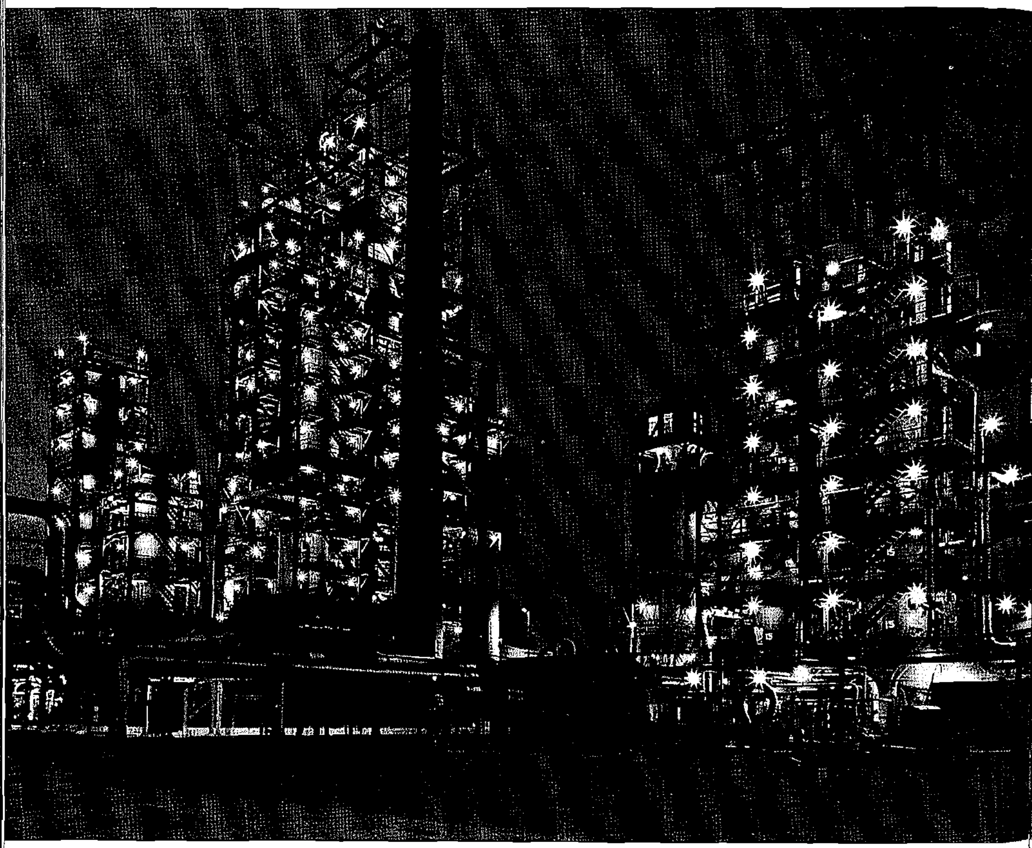
Long days away from home, tramping through industrial plants and talking to public relations men, combined with long hours in front of a typewriter trying to make facts and figures intelligible, made me appreciate more than ever the help of my wife, Dot, and our Jay and Ruth. To them, even more than all others, I am indebted for cheerfulness and encouragement when I needed them most.

John T. Cunningham

Florham Park, N. J.
July, 1954

CONTENTS

Petroleum refining functions around-the-clock, as these lights on Esso cracking units readily show.



PETROLEUM

Ask the average man about petroleum. He'll be vaguely aware that it has made a lot of Oklahoma Indians and Texas Texans rich by flowing out of the ground like liquid gold. He'll reckon that something is added, or taken away, maybe, before said liquid gold goes from the soil into his automobile or oil burner. Somehow though, it all seems so far away from the furiously ticking meter on the gas pump.

True enough, no petroleum has been tapped in New Jersey, not enough to gush about, at any rate. Tales of oil prospecting in the South Jersey pinelands seep occasionally into the papers; the fact is that petroleum may yet be found here, a pleasant prospect to keep in mind when crops are slim.

But for the present, liquid gold belongs to the Southwest and Gulf Coast, as far as the wells and gushers are concerned. Nevertheless, Texas oil men have more than a passing interest in New Jersey refineries—although in all fairness, seven billion gallons of crude oil one way or another might not even be noticed in Texas.

Seven billion gallons is not a figure plucked out of thin air; that's the approximate annual capacity of refineries clustered within two small New Jersey areas, one close to New York, the other within easy reach of Philadelphia. Seven billion gallons is enough to put the state in sixth place nationally in the petroleum refining industry, and adds up to astounding New Jersey-made quantities of everything from aviation gasoline and fuel oil to asphalt and wax. Petroleum refining capacity is expanding rapidly in the state, too, being now nearly double the capacity of 1945.

The reasons for New Jersey's vital refining role are easy to delineate; good markets and good transportation. Those reasons have not changed materially in the eight decades since oil men first cast eager glances on the marshlands of Bayonne, close to New York City's buying public, close to rail and water carriers.

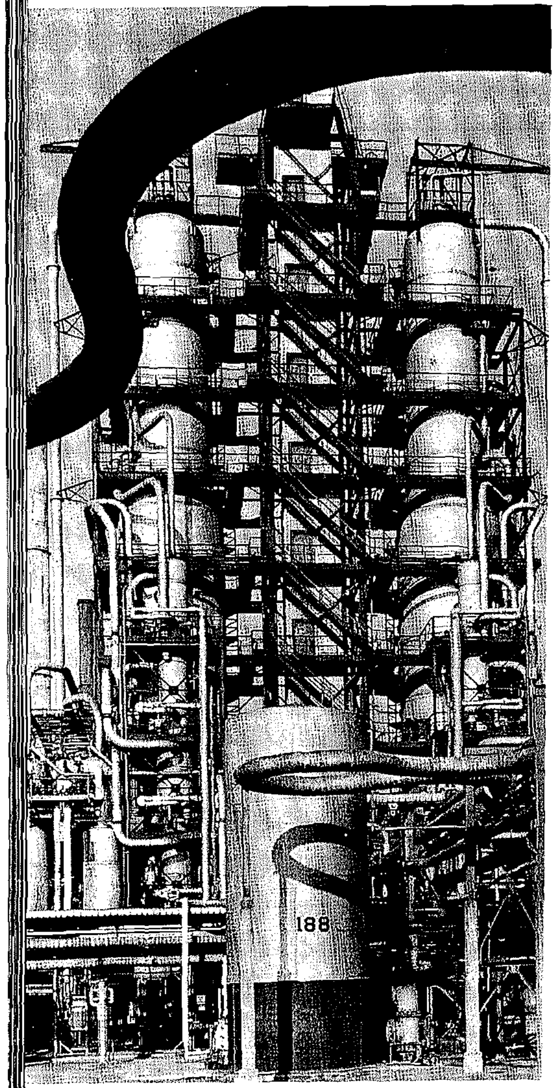
Bayonne had one other thing in 1875, when Prentice Oil Company established the state's first crude oil refinery. Quaint old Bayonne, favorite watering place of the rich and fashionable of New York, had room to spare. Prentice's decision to utilize some of the marshlands troubled no one initially; the fine beaches on Newark Bay continued exclusive enough to be called "The Newport of New York."

Then a darkness settled over Constable Hook, caused by the dense black smoke eddying outward from the waste fires of Prentice and other early Bayonne oil neighbors, including Ocean Oil Company, Lombard Ayres & Company and Polar Oil Company. The refiners protested that after taking the valuable kerosene and some machine lubricants from the crude oil, nothing could be done with such objectionable leftovers as gasoline except burn them. Away went the vacationists; no longer would Bayonne soot them.

A young fellow named John D. Rockefeller, along with his associates in the Standard Oil Company of Cleveland, built a refinery in Bayonne in 1877. Within a few months Standard also took over Prentice Oil—20 employees, 600-barrel-a-day capacity and all. John D. and friends had stolen a march on the entire industry, getting so close to progressive New York, whose people probably owned the most kerosene lamps in all the world.

Out in Pennsylvania, not far from the wilds of Titusville where Colonel Edwin L. Drake had drilled the world's first successful oil well in 1859, two men set out in 1869 to challenge Standard Oil. Seventeen times Byron D. Benson and Major Robert E. Hopkins drilled deep into the Pennsylvania oil fields; seventeen times Benson and Hopkins found nothing.

Oil flooded from the earth on the eighteenth try and the partners had a pleasant new problem: marketing the gushing riches flowing about their feet. They agreed the best sales country lay at tidewater and thus established their Tide Water Oil Company


Some of intricate equipment at Esso's Bayway Refinery.

refinery at Bayonne, only to find that competitors controlled the railroads. Accordingly, railroad lines refused to carry Benson-Hopkins crude.

The oil world scoffed when news leaked out late in 1878 that Tide Water had decided to build a 288-mile pipeline over the Allegheny Mountains, over the lesser hills of New Jersey and under Newark Bay all the way to Bayonne. Less than a year later, nonetheless, piped crude flowed 110 miles over the Alleghenies to Williamsport, Pennsylvania.

Jersey Central Railroad then agreed to take oil from Williamsport to Bayonne in tank cars, and before the end of 1879 the brash young Tide Water Company had acquired the Ocean, Polar and Lombard Ayres refineries in Bayonne. Standard, shaken by the audacity of little Tide Water, fought back.

John D. Rockefeller and friends had the money to build bigger and better; by 1880 their pipeline stretched 400 miles from gushers at Bedford, Pennsylvania, to Bayonne, being the first pipeline to reach tidewater. The last mile proved toughest for Standard Oil Company, since mountains and rivers could not cause nearly the trouble created by the uncooperative mayor of Bayonne.

Central Railroad bitterly fought the new Standard Oil pipeline. Bayonne's mayor, possibly out of the purest of motives, vetoed a council resolution permitting Standard's pipeline a right-of-way through 30th street. Standard Oil, also possibly with the purest of motives, campaigned actively in the next election; the good people of Bayonne elected a mayor and a council friendly to the oil company.

On the evening of September 22, 1880, the petroleum-minded Mayor and Council passed an ordinance creating a pipeline right-of-way in 30th street. A messenger rushed the ordinance to Standard's yards, where 300 men waited in the red glare of their kerosene lanterns. By dawn trenches had been dug, pipe laid and trenches filled in again, even before the city populace (or the Central Railroad) knew an ordinance had been considered.

Tide Water's pipeline finally inched into Bayonne in 1888 and the oil war settled into more or less friendly competition, with room for all. Tank steamers carried refined oil outward in their steel holds and sailing ships put oil-filled wooden barrels in their holds to take abroad. Close to home, kerosene stoves became a popular extension of the warmth of the parlor stove or a summer substitute for the kitchen cook stove. Steam engines and big machines used more and more petroleum lubricating oils instead of the whale sperm or lard oils of an earlier day.

Just over the horizon, if any one listened and believed, a new factor began to chug into the oil landscape. The census writer of 1899 heard, believed and reported: "The recent extraordinary growth of the automobile industry . . . has stimulated the development of small internal-combustion engines of from three to 40 horsepower."

Four New Jersey oil refineries produced 8,600,000 barrels of petroleum products in that same year of 1899, with 6,200,000 barrels being "illuminating" oil, 1,300,000 barrels being fuel oil, and only 1,100,000 barrels being naphtha or gasoline (also known variously as "motor spirit," "680 spirit," "boulevard gas fuel" or just plain "petrol").

But horseless carriages didn't turn the heads of good sound oil men. Look at the figures, they said, reasonably enough: only five automobiles built in all of 1895, only 22,000 built in the entire country in 1904. Kerosene, that's our business, they insisted as they expended to tap bigger and better oil fields in the Southwest.

Standard Oil Company and Tide Water employed a total of 3,000 men between them and refined 40,000 barrels of oil daily in their Bayonne plants in 1904. Bayonne correctly boasted that the longest pipeline in the world—1,800 miles from Standard Oil Company to "Indian Territory"—ended in the Hudson County peninsular city.

Still, congestion moved in on Standard Oil, not only in Bayonne but also at its big Eagle Works in Jersey City. The company looked longingly across Newark Bay and down the Arthur Kill to the marshy farmlands near Morse's Creek in Linden. Late in 1907 Standard Oil Company began to build its sprawling new Bayway refinery.

Bayway offered several advantages: room to grow, deepwater transportation, good railroad connections and a terminal on the Tuscarora pipeline which stretched to the oil fields of Pennsylvania. Moreover, the area had good petroleum refining know-how, centered in the old Borne, Scrymser Company in nearby southern Elizabeth.

Started in 1883, the waterfront oil refinery of Borne & Scrymser had achieved world-wide markets by 1890 as the firm pioneered in making a wide range of petroleum lubricants to compete in a lubricating market long prejudiced in favor of whale sperm and lard oils. Borne, Scrymser Company boosted its daily capacity from 300 barrels in 1883 to more than 1,000 barrels daily by 1889. Today the company is still operating after more than seventy years in business.

All petroleum refining in the East suffered in com-


Night work proceeds at California Oil Company in Perth Amboy.

parison with Standard Oil's Bayway refinery after the first still was lit there in 1909. Every one recognized the vastness of the enterprise, yet few Linden folks called the plant other than "Tom Glackin's kerosene factory," in dual tribute to the forcefulness of Glackin, the hard-driving, colorful Irish foreman and in recognition of the principal Bayway product. Even in 1909 kerosene dominated the most advanced petroleum refineries.

But grudgingly or otherwise, only the most ardent horse lovers failed to agree in 1909 that the automobile had come to stay. Gradually the percentage of gasoline distilled from crude oil increased until by World War I the motor fuel had pushed kerosene into a secondary place.

World War I brought fantastically increased demands for refined gasoline and oil; the total export of gasoline rose from 4,600,000 barrels in 1913 to 13,500,000 barrels in 1918. The AEF doughboys jolted over the rutty French roads in motor trucks as much as they walked in the muddy fields. Overhead, the first warplanes sputtered and fought an aerial war that forecast the nature of things to come. This all added up to great quantities of burned gasoline and oil, and, as Lloyd George said, "the Allies floated to victory on a sea of oil."

Two factors entered the picture to alter New Jersey's refining setup between 1900 and 1920. In the first place, other companies built New Jersey installations to compete with Standard Oil Company and Tide Water; secondly, violent labor unrest in Bayonne seriously threatened the state's petroleum industry in 1915 and 1916.

Bayonne continued a favored spot for oil works. Gulf Refining Company built a terminal plant (in effect a warehousing and distribution center) in the city in 1901, and the Texas Company added its terminal plant in 1910. Down along the Delaware River the Vacuum Oil Company (now Socony-Vacuum) built a modern refinery at Paulsboro (Gloucester County) in 1917 with a 20,000-barrel daily capacity. The Warner-Quinlan Company started a small refinery at Linden in 1912 (which Cities Service bought in 1937).

Bayonne strikes in 1915 and 1916, involving thousands of workers at Standard and Tide Water, etched themselves into labor history because of the unprecedented brutality accorded the strikers at the hands of known criminals brought in to break up the walkout. Pearl Bergoff, self-styled "King of the Strikebreakers," paid by the companies to lead a frontal attack on the workers, possibly went beyond the instructions of his superiors. At any rate, three strikers and a boy died in a five-day reign of terror. Out of the bloodshed came enlightened petroleum industry labor policies, fortunately.

Labor peace made the industry bound ahead, with the state making nearly 25 per cent of all United States refined petroleum products during World War I. By 1919 New Jersey led the country in average number of petroleum workers with 10,178 recorded that year. The value of petroleum products, $280,-995,000, placed the state second only to California in the country as a refinery center in 1919.

Postwar refining slumped throughout the country in 1923 as all European refineries, particularly Russia's, picked up capacity and added to the huge American surpluses of refined gasoline and fuel oils left over from the war. A definite indication of hard times manifested itself in two prices announced at the refineries: Gasoline, 7½ cents per gallon; kerosene, 7¼ cents per gallon. Those two had not been that close in cost since Henry Ford put the automobile within reach of most Americans.

Not that the petroleum industry faced collapse. Standard Oil had pushed its production to 180,000 barrels daily at its Jersey City, Bayonne and Bayway plants (80,000 barrels daily at Bayway alone). Only Tide Water came close to Standard Oil in production with 36,000 barrels refined each day in Bayonne in 1923. Figuring every barrel to hold 42 gallons, it can be seen that the refineries kept busy.

Increased use of home oil burners in the 1920's got the petroleum industry rolling briskly; gasoline pushed the industry into high gear. Pressure stills made more and more gasoline available out of each barrel of crude oil, and, particularly pertinent, led to continuous operation without frequent shutdowns to clean equipment.

"Cracking" coils, designed to refine crude oil under very high pressure and great heat, began to replace the old low-pressure stills as the 1920's wore on. For the user of gasoline those coils meant a higher grade product. Charles A. Lindbergh, when he pointed the propeller of his "Spirit of St. Louis" into the wind in May, 1927, had the secure feeling that his improved 75 octane gasoline would help him make Paris. ("Regular" gasoline at any standard-brand pump today has an octane rating well above that of the fuel used by Lindbergh.)

By 1930 New Jersey had begun to slip in relation to the rest of the country in petroleum refining. Not that the state's capacity declined; rather it increased, but not as rapidly as Texas and California, where oil men built new refineries close to the spouting wells. Still, New Jersey continued fourth in refining capacity

nationally in 1940, with a daily average of 255,950 barrels.

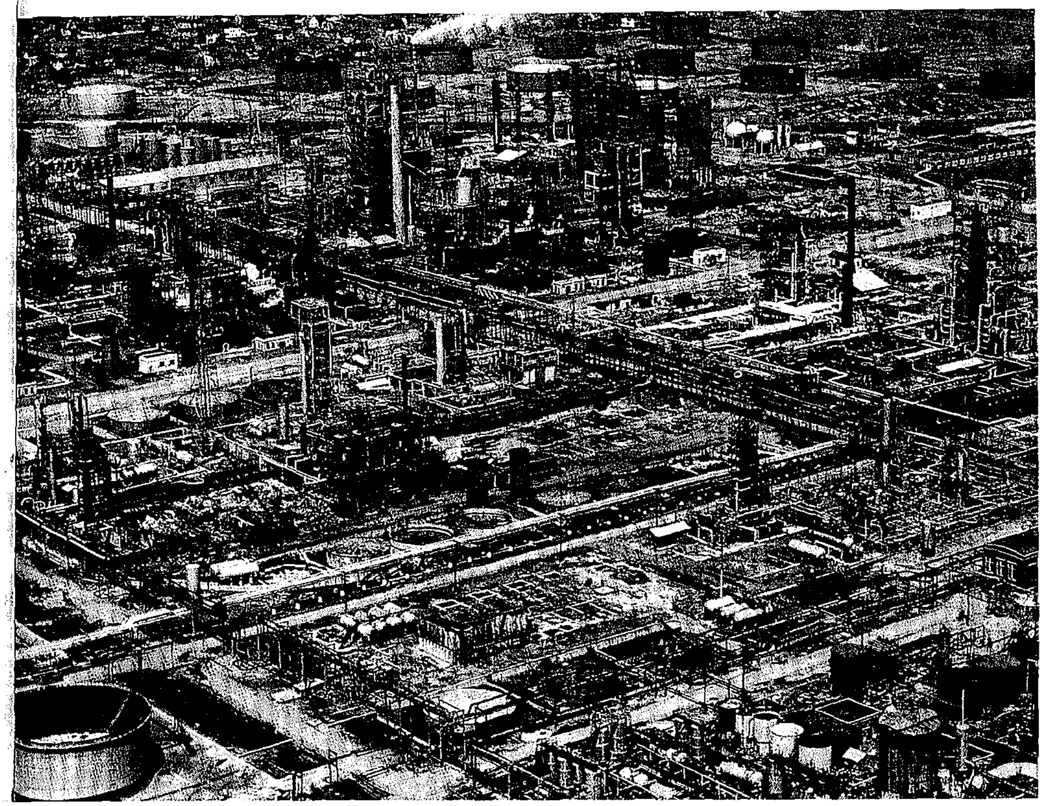
World War II again threw New Jersey and all Eastern refineries into welcome relief. Nazi submarine packs haunted the Atlantic coast and sent loaded tankers plunging to the bottom. Surging seas washed over the wrecked tankers and splashed great black crude oil smudges over the entire Jersey coast as grim reminders that not all the war was being fought 3,000 miles away.

The government placed its fullest resources behind building the "Big Inch" and "Little Inch" pipelines from Texas to Linden. The 1,363-mile "Big Inch" came first, and that 24-inch pipe brought oil from Longview, Texas, to Linden in August, 1943. When the last oil flowed through the "Big Inch" on October 15, 1945, the pipe had brought 260,750,000 barrels of petroleum (including refined products as well as crude oil) to the East.

"Little Inch," named because the 20-inch diameter of the pipe was less than its predecessor, stretched overland 1,475 miles from Beaumont, Texas, to Linden. This line held 2,000,000 barrels of oil, flowed at the rate of 122 miles per day and took 12½ days for a given product to flow from Beaumont to Linden. The first petroleum product via "Little Inch" reached Linden on March 2, 1944, in the midst of a severe fuel oil shortage—and, ironically enough, throughout the first day a naphtha cleaning fluid ran from the pipe. Happily, fuel oil for North Jersey burners soon inched its way through the state and out of the line at Linden on March 3.

Natural gas replaced petroleum products in both "Inches" after prolonged legal bickering following World War II, but the two great pipelines had served the nation well. Not only did they bring fuel oil to cold New Jersey homes, they also brought aviation gasoline for relatively easy transshipment to fighting

General view of Bayway Refinery, largest in New Jersey, with a daily capacity of 150,000 barrels.



Drawing crude oil sample from a Bayway storage tank.

men in Europe. Moreover, the much-debated pipelines also made a substantial profit for the government, a fact usually overlooked by critics of the two "Inches."

The petroleum industry, matured by the depression and tested by World War II, entered the years following V-J Day with facilities far beyond the comprehension of those who lived in the days of Tom Glackin's kerosene factory. For one thing, refining reached a new high with the introduction of catalytic units, a development whereby a catalyst does most of the "cracking" (refining) of crude oils into gasoline under lower pressure, thus permitting the manufacture of high quality gasoline at low cost. Catalytic cracking also permits the recovery of more gasoline per barrel of crude oil. Today Esso's Bayway refinery has the biggest "cat" cracker in the world, while another "cat" at Tide Water in Bayonne has established world records for the longest initial run and the longest continuous runs for a cracker.

New Jersey's role in World War II also caught the attention of two other major companies, California Oil Company and the Texas Company, which moved refining operations into the state in 1947 and 1949, respectively. Together these plants represent the very newest thing in oil refining and between them they have increased the state's refining capacity by 125,000 barrels daily.

California Oil came to New Jersey by buying out the old Barber Asphalt Company, which since 1903 had been making asphalt at its Perth Amboy plant. Since 1947, California Oil Company has spent $100,000,000 expanding the plant's capacity to about 60,000 barrels of crude oil a day. Everything new has gone into the plant—"cat" cracker, tankers, storage tanks, stills—to develop the refining of Calso products in New Jersey. California's products range from asphalt to aviation gasoline, with motor gasolines, kerosene, light fuel oil and bunker fuel oil between those extremes.

Texas Company went across state for its newest refinery, choosing 1,600 acres of wide open land spread over 2¼ miles of waterfront on the Delaware River at Westville, just south of Camden. The spreading site had once been Washington Park, an amusement place noted throughout the Philadelphia-Camden area from 1895 until fire leveled the park in 1909.

Starting completely from scratch, as no other New Jersey refinery has done since the turn of the century (even Calso incorporated the old Barber buildings into its operations at Perth Amboy), Texas Company built what has been called a "picture refinery" because of the neat layout of buildings, crackers, stills and storage tanks. The new refinery went "on stream" (began operations) late in 1949.

Every refinery in New Jersey is in the midst of expansion; as one plant superintendent put it, "Refineries are always expanding." The state's refining capacity has nearly doubled in the past decade, from a daily capacity of about 250,000 barrels in 1945 to more than 475,000 barrels today.

Esso's Bayway plant is far and away the biggest refinery in New Jersey, with a daily capacity of 150,000 barrels (42 gallons each) or 6,300,000 gallons daily. One fact concerning the Bayway refinery brings home a reason for locating on deep water other than to provide ship channels for heavily laden tankers. Bayway uses enough salt water daily to equal the amount of fresh water needed every day by Philadelphia or Detroit, the water being used to cool refined products after the tremendous heats used in converting crude oil into its usable components. All refineries use great quantities of water, in proportion to their production.

Esso's other major New Jersey refinery, at Bayonne, is a specialty plant, with its major output being asphalt, lubricating oils for industrial uses, and wax. The Bayonne refinery processes 2,500 barrels of lubricants, 5,000 barrels of asphalt and 560,000 pounds of wax daily. Possibly the wax production is the most striking to the average person, particularly when it is realized that Esso makes 20 per cent of

the world's annual wax consumption at its Bayonne plant.

Unlike Esso's specialization, Tide Water makes nearly every type of petroleum product in its Bayonne refinery (excluding only wax). Tide Water has come a long way since the days when Benson and Hopkins dared push their pipe line from the mountains to the sea, and now the truly "tidewater" part of the company can handle 75,000 barrels of crude oil daily in Bayonne.

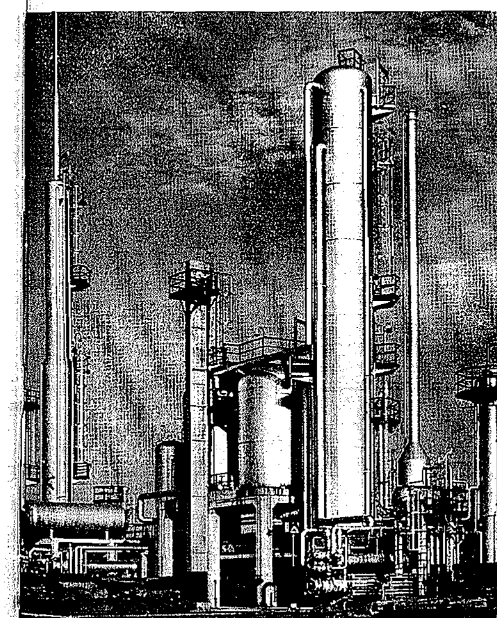
Perhaps the most diversified refinery in the state is that at Paulsboro, where Socony-Vacuum literally makes everything in the petroleum field—asphalt, wax, fuel oils, gasolines, petrochemicals. Socony-Vacuum is one of the very few refineries in the country processing every product, since most specialize in selected crudes (low wax, low asphalt, etc.).

One hallmark of the petroleum industry in the state is the concentration of research activities within New Jersey, two notable examples being Socony-Vacuum's research laboratory at Paulsboro and the Esso Research Center in Linden. Other companies maintain research activities, too, and laboratory scientists within the state have explored, and continue to explore, the petroleum industry in a range extending from the improvement of high octane gasoline to the production of synthetic rubber, synthetic alcohol and synthetic toluene for use in explosives. This phase of the industry will be given broader attention in a later chapter on general research activities in New Jersey.

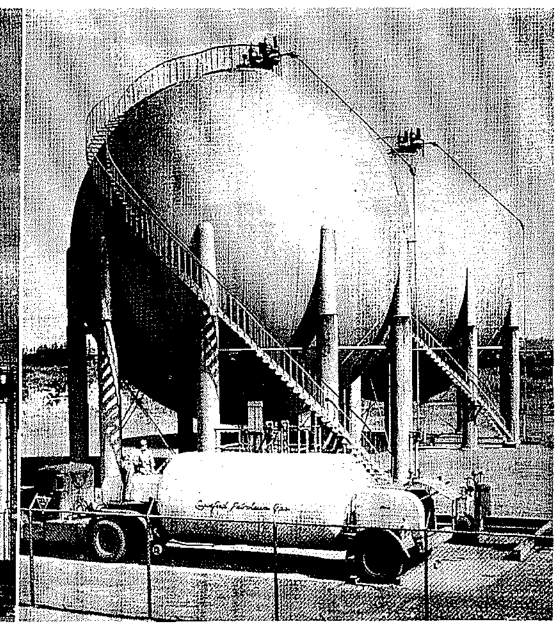
Now, with the petroleum industry well past the midpoint of the twentieth century—yet less than a century since Colonel Drake struck oil in Titusville—New Jersey is solidly established as a leading petroleum state. Its seven refineries have a total capacity exceeding 475,000 barrels daily (42-gallon barrels). This figures out annually to about seven billion gallons of every known petroleum product.

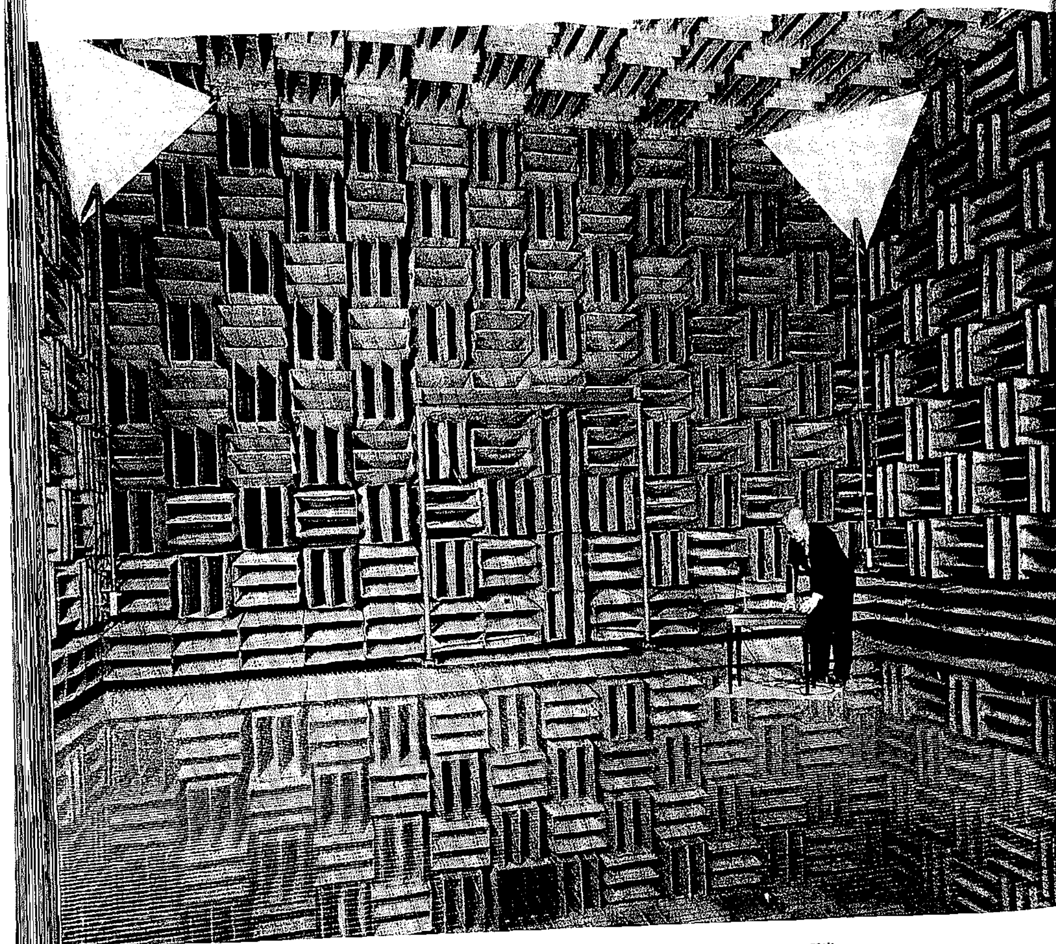
Yet, not one drop of oil comes from a New Jersey oil well at the moment—and don't buy any stock in a company proposing to tap an alleged oil field in the state. At least, not without consulting your broker. Oil wells in New Jersey are possible but, at the moment, not probable.

Thermal reformer at California's Perth Amboy refinery.



Two of Tide Water's great round storage tanks at Bayonne.





Sound is taboo in unique acoustical chamber at Bell Laboratories in Murray Hill.

RESEARCH

Build a better mousetrap, the old advice goes, and the world will beat a pathway to your door. Shake that truism well, blend it with a bit of The-World-Is-At-The-Crossroads theme and there emerges the traditional commencement address, with every word just as true today as it was fifty years ago.

The fact is that the world has always sought the figurative better mousetrap, or, more particularly, the type of mind capable of developing it. The same uncanny mental processes required to improve methods of snaring a rodent can also make a superior jet plane or a better antibiotic.

Today, of course, mice serve far greater scientific purposes than merely testing new traps, but the basic philosophy of the improved mousetrap is still sound, sound enough to make industry beat a very significant pathway to the bright doors of hundreds of research laboratories spread throughout New Jersey.

No other state tops New Jersey in the magnitude and diversity of research carried on in more than 400 laboratories located within the state. The search for betterment is everywhere in New Jersey; it is found in unprepossessing old buildings in the cities and in shiny new laboratories on the most handsome of the suburban hills.

Somewhere between 12 and 15 per cent of all United States research is carried on in New Jersey; no one can say for sure how much. Security regulations, combined with the elusive nature of the quarry, make it hard to ensnare research in exact statistics. Still, settle for 12 to 15 per cent—and that means about one-seventh of all national research is crammed within a state occupying only 1/370 part of the country.

Research and its close cousin, development, are the real keys to the current level of $5,000,000,000 in value of goods manufactured annually in New Jersey. More important, work going on in laboratories today bodes well for tomorrow; research is to industry what spring rains are to summer pasturelands. It's almost axiomatic to say that where money is spent on research, there industry thrives.

The entire concept of the research laboratory as it is now known is a phenomenon of the last thirty years. If there are industrialists who begrudge the importance of research, their voices are not loud. Quite simply, and over and above altruism, in today's competitive economy a company either spends money on research or falls behind its rivals.

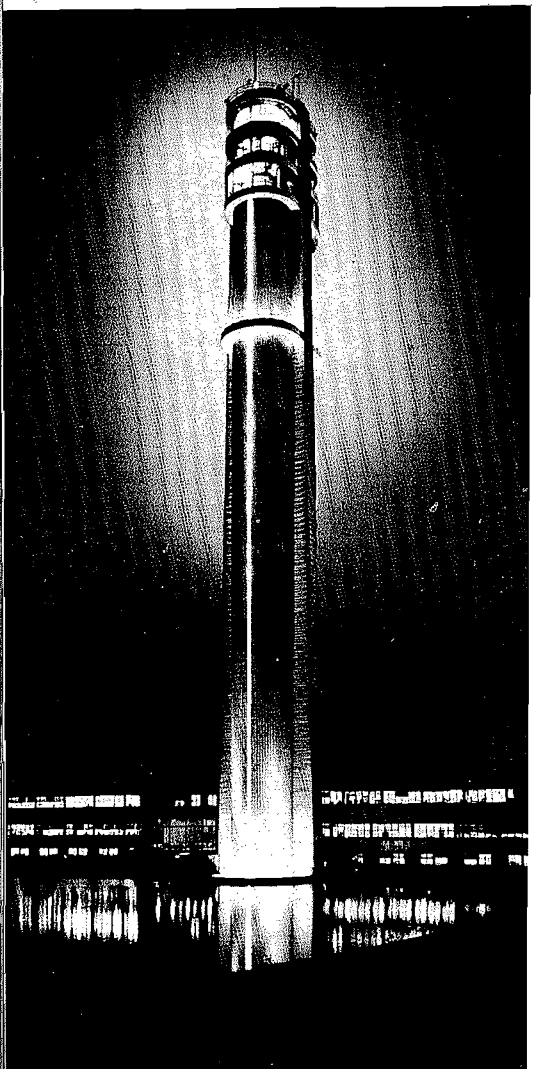
Two things have particularly characterized new research laboratories in the past two decades—quiet locations in the country, and a gathering together of many scientific and technical skills to work as a team. These are not new notions. Thomas A. Edison's heralded Menlo Park laboratory had both of those desirables way back in 1876.

There are many who believe that Edison's greatest contribution to the world was his conception of a highly organized research laboratory. No one else had succeeded before 1876 in drawing together bright minds and skilled hands to put inventiveness on a production-line basis.

Edison deliberately sought a peaceful spot as the location of the world's first research laboratory. He found it on a high hill in Menlo Park, then sanguinely announced his intention to speed up inventing. He envisioned a minor invention every ten days, a major invention every six months.

Thus, out of the mouse-filled garret and into bright clean rooms came the scientist. Edison surrounded himself with high level knowledge. He hired chemists, engineers, model makers, theoretical scientists, mathematicians and skilled mechanics. His force totaled sixty-one men, dedicated to the cooperative pursuit of invention and presumably happy to be in the quiet Jersey hills where strawberries bloomed in June.

Team-work paid off, and more than 300 separate patents resulted from work at Menlo Park between 1876 and 1882. Three of those patents—for the phonograph, the electric lamp and the "Edison Ef-



Federal Telecommunications "Laboratory In The Sky."

fect," the forerunner of the radio tube, clearly etched Edison's name into the annals of science.

Certainly Edison had no corner on research. Edward Weston's Newark laboratory, for example, pioneered American measuring instruments. Scientists at Kenvil advanced the knowledge of powder making. With rare exceptions, however, industry did little research within its own domain. Why improve methods or products, industrial heads argued, when what grandfather bought still sold readily to his grandsons?

Industrial historians credit E. I. duPont de Nemours Company with establishment in 1902 of the first important American industrial research laboratory. DuPont chose a New Jersey location for that installation too, setting up the new facility at its Repauno dynamite plant in Salem County.

It can hardly be said that the duPonts plunged recklessly into research, since only six young chemists crossed the river from Wilmington to Repauno. No particular favors were accorded the scientists, either. They carried all their equipment with them—two small cases of glassware, a few chemicals and a microscope.

World War I shocked industry into intensified research, particularly after national leaders awoke to the fact that Germany's government-encouraged laboratories had given the Kaiser a big drop on the world. Out of the first major world war came the real seeds of organized industrial inquiry. Still, research expenditures in the entire United States in 1920 probably did not exceed $300,000,000 per year.

World War II, for all its tragic implications, finally brought American research and development into full flower. Laboratories found answers to seemingly insoluble problems. Ready supplies of government money encouraged even very small firms to expand research programs. Germany's admitted scientific skills called for an all-out laboratory fight, a fight every bit as important (even if not as personally distressing) as struggles in front-line foxholes.

Today industry has expanded research expenditures ten-fold over what they were three decades ago. Industrial survival is as simple and as expensive as that at the mid-point in the twentieth century. The billions of dollars spent for scientific know-how have paid off; more than 50 per cent of products in common use today were not even known fifty years ago.

Somewhere between $150,000,000 and $200,000,000 is poured into New Jersey research installations every year. Those sums are spread over a wide geographic area, into about 150 separate municipalities. They are spread over a broad product area, too—food, television, petroleum, electronics, aerodynamics, communications, textiles, metals, explosives, pharmaceuticals, chemicals, plastics, rocket motors, electric lamps, air conditioning. Whatever the product, it is almost surely undergoing research in New Jersey.

The airplane is a good example of what New Jersey science is doing about tomorrow. Engineers who have pierced the sound barrier owe much to New Jersey aircraft skill.

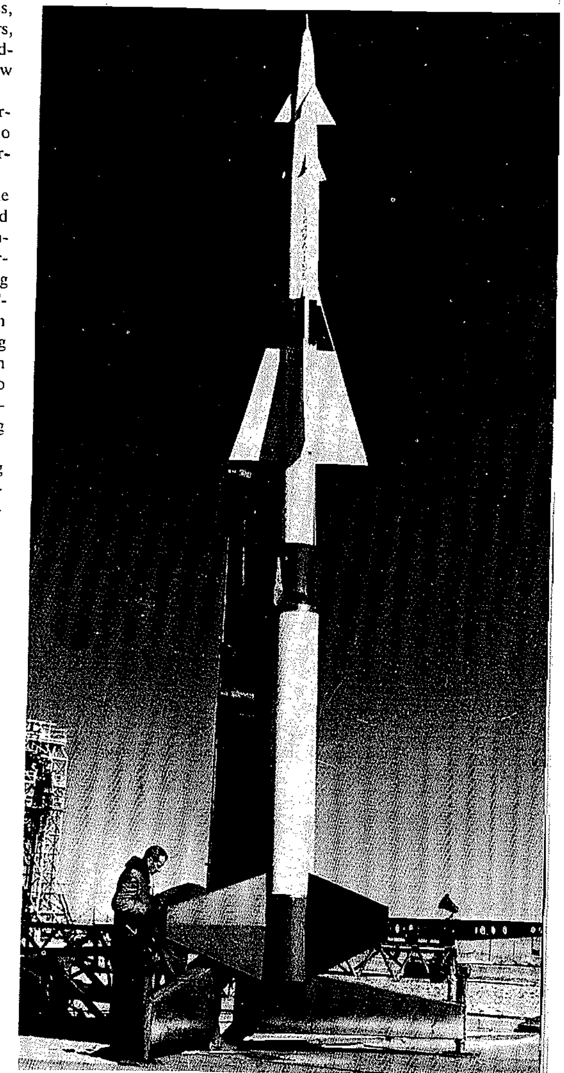
Curtiss-Wright Corporation has centered a sizeable portion of its search for better airplane engines and propellers in New Jersey. The firm's new power inquiry is spread through turbo compound motors, turbojets, and the ram jet. The ram jet (the "Flying Stovepipe") is the latest announced Wright engine advance. Capable of withstanding temperatures as high as 3,000 degrees F., the "Stovepipe" has no moving parts and is at maximum efficiency at speeds between 1,500 and 3,000 miles per hour. It is reasonable to assume that engines destined to make the ram jet old-fashioned are on the drawing board or in engineering minds at Curtiss-Wright.

Curtiss-Wright is not the only one bent on putting the mere speed of sound into the aeronautical foot-dragging class. The M. W. Kellogg Company in Jersey City is in the midst of highly-secret work with ram jets. Up in the hills of Morris County, Reaction Motors Incorporated is deep in rocket research and development.

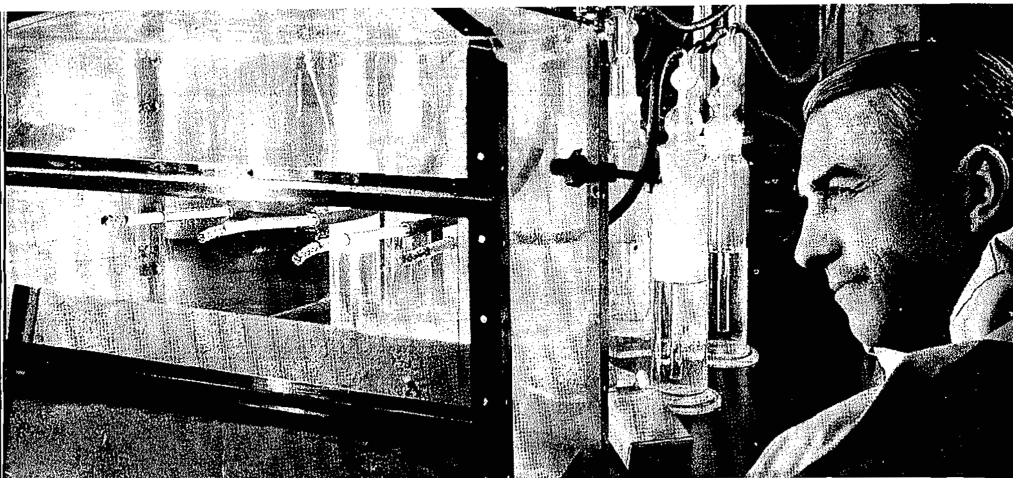
Reaction rockets already have thrust experimental aircraft far beyond the speed of sound and have carried Navy Viking rockets aloft at 4,100 miles per hour. Again, those are announced achievements; obviously rocket science looks ahead. Reaction Motors will base its look ahead in a new $2,500,000 research laboratory under construction in Denville near the Rockaway Township line.

Every jet or rocket development brings incredible new problems, of course, and the James Forrestal Research Center at Princeton University is concerned with those problems. More than 500 Forrestal Center scientists and assistants are easing the rocket into the future, and finding that the land at the other side of the Sound Barrier has completely repealed most of the laws relating to such old-fashioned airplane speeds as 300 to 400 miles per hour.

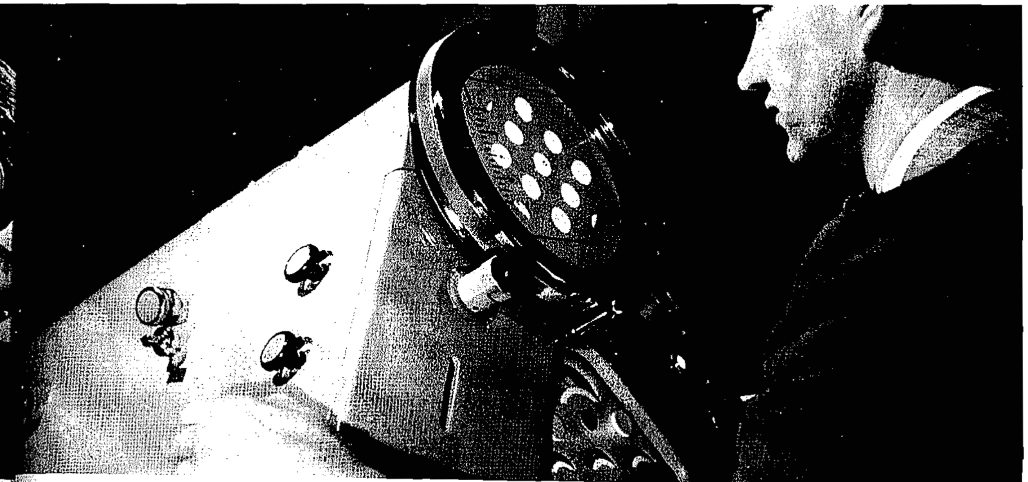
Since mankind has only just crashed the Barrier, there is much to be learned and much to be developed if supersonic speeds are to be of any practical use. Forrestal Research Center is studying rocket and jet motors in specially-constructed buildings on the shores of Lake Carnegie. Two unique wind tunnels can simulate altitude from sea level to 100,000 feet.



NIKE, antiaircraft missile whose "brain" was developed by Bell Laboratories researchers in Whippany.



Mechanical "smoking" machine tests cigarette action at P. Lorillard in Jersey City.



Standard Oil scientist uses electron microscope in experimentation with minute items.

Princeton scientists are working closely with government and military agencies and with private industry —and aircraft's future rides as much at the Forrestal Center as it does anywhere in the world.

This onslaught on space calls for new metal alloys, new instruments, new fuels, and New Jersey laboratories are meeting the challenge. New metals and alloys are under particularly intensive study at the recently-completed $1,200,000 South Plainfield laboratory of the American Smelting and Refining Company. New instruments are being readied by scientists in laboratories of such companies as Weston Electrical Instrument Company in Newark and Bendix Aviation Corporation in Teterboro.

Fuel to drive the aircraft of tomorrow is a primary concern of petroleum researchers, who must at the same time concern themselves with that greater portion of mankind content to roll along in automobiles. Fuel research leads directly to the door of the Esso Research Center in Linden, probably the world's leading petroleum laboratory.

The automobile fathered the Esso Center, although the twenty-six men who started research and development work for Standard Oil Development Company back in 1919 certainly never envisioned the facilities now available at Linden. Nor, for that matter, could they possibly have foreseen the changes a mere thirty-five years could make in petroleum outlook.

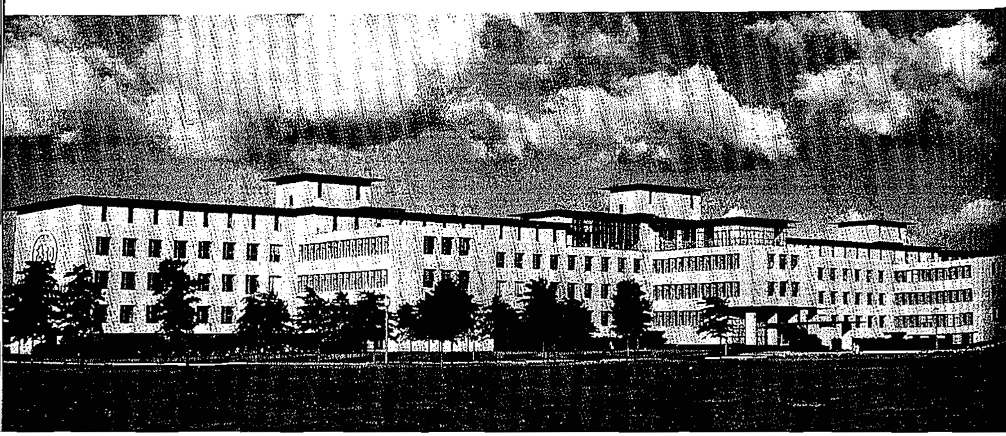
Rolling years have brought better gasolines and lubricants, with many of the advances directly traceable to work at Linden. Improved methods of cracking and better catalytic processes owe much to Esso contributions in Union County. The governing theme at the Esso Research Center is creation of energy, naturally, but work at Linden also has spread into many other channels.

During World War II, long years of work at Linden on synthetic rubber brought Butyl to a rubber starved nation. Today Butyl is used almost exclusively in this country for the manufacture of automobile inner tubes. Similarly during World War II, Esso scientists perfected the volatile fluid used in fire bombs and pioneered in development of smoke screen generators.

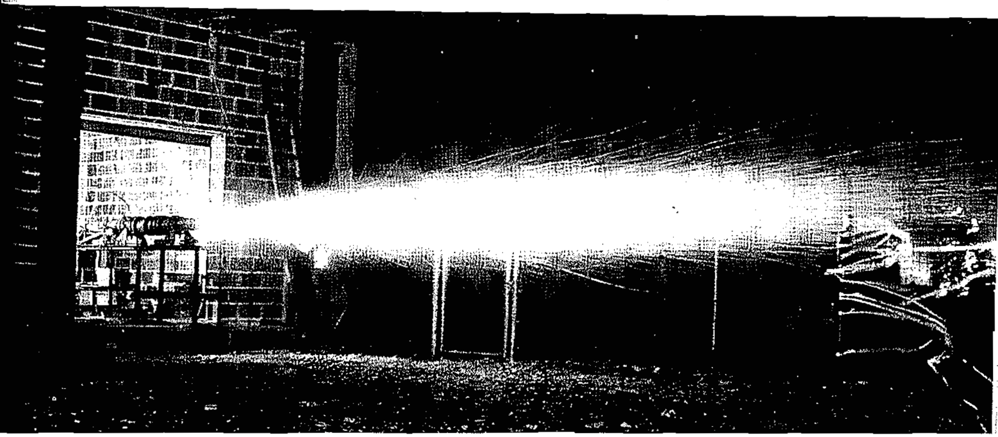
While work must continue to improve gasoline for the road-minded citizen, Esso Research Center also is deep in the jet age. Recently the Center announced a new jet lubricant, which does not evaporate at high temperatures or congeal at low temperatures. Another horizon in the Linden laboratory is petro-chemicals—the development of petroleum by-products into useful chemical compounds.

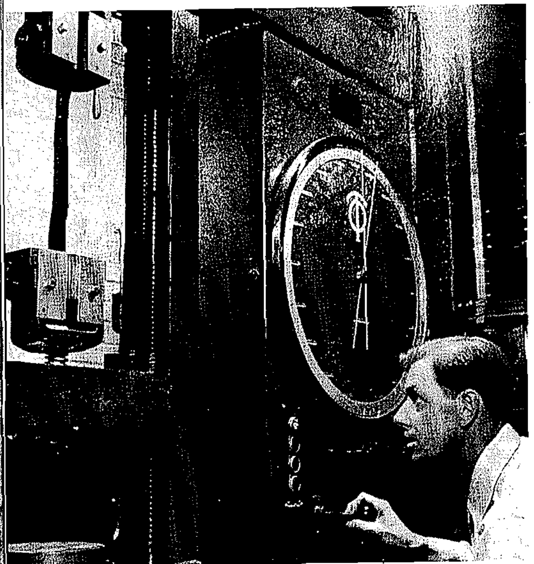
By devoting a major share of attention to the chemistry of petroleum, Esso Research Center is right in the midst of what might be the greatest research movement of all times, the development of new products through chemistry. Nothing has highlighted the advance of controlled scientific inquiry like relatively recent research in the fields of organic chemicals, pharmaceuticals, plastics, paints, explosives and many

Typical of university-like atmosphere of research labs is Esso Research Center.



Flaming ram jet is part of Esso research project undertaken for U.S. Navy.





Butyl-covered glass cloth is tested in Esso rubber section for tensile strength prior to use in irrigation ditch.

other chemical commodities.

Fortunately for New Jersey, since there is every indication that chemical research may hold in its test tubes much of tomorrow's way of life, the state is the center of multifold chemical laboratories. Most of these are centered in the teeming industrial areas of Essex, Union, Somerset, Hudson and Middlesex counties.

Chemical research picked up pace amazingly in the early 1930's, in the midst of a depression that made many an "all-eggs-in-one-basket" industrialist collapse. At a time when many industries wondered if the sun would ever shine again, chemical houses used their laboratories to start rolling back the clouds.

Untold millions of dollars of risk capital went into Jersey pharmaceutical research. Merck & Company started a vast program in 1933, and soon afterwards other pharmaceutical houses began exploring their own destinies—firms like Schering in Bloomfield, Hoffman-LaRoche in Nutley, Warner-Chilcott in Morris Plains, E. R. Squibb in New Brunswick, American Cyanamid in Bound Brook, and Ciba Pharmaceutical Company in Summit, to mention a few.

Thus capital risked at the worst economic period in all American history, paid off, and doubly, in great new life-saving miracle drugs and in profits for the investors in research. The Jersey-developed health-givers—sulfa drugs, streptomycin, cortisone, vitamins, hormones—are well known. Increased company income can be proved as well; recently, by way of illustration, the Schering Corporation of Bloomfield announced that 65 per cent of its gross 1953 income came from products developed since 1948.

Du Pont company's research is a hallmark of the twentieth century, and New Jersey remains vital in du Pont's exploration of better living through chemistry. Du Pont explosives research is still centered at Repauno and smokeless powder research is carried out in laboratories at Gibbstown and Carney's Point. More than 1,000 persons are engaged in du Pont's organic chemistry research, all of it located at Deepwater Point in Salem County. Color research is centered in Newark, photo products research is based in Parlin. So du Pont recognizes the value of New Jersey as a research spot as much as it did in 1902.

Much of the nation's high explosive know-how remains alive in New Jersey, at du Pont installations, at Hercules Powder Company in Kenvil and at Picatinny Arsenal, Lake Denmark Naval Ammunition Depot and Earle Naval Ammunition Depot.

Much of chemistry's attention is now devoted to plastics, and in that synthetic area New Jersey is a national leader. A great deal of looking ahead in plastics is going on in laboratories like those of Celanese in Summit, du Pont in Arlington, Hercules at Parlin and Burlington, Union Carbide and Carbon Corporation (Bakelite) in Bloomfield, American Cyanamid in Bound Brook, and many other companies.

It goes almost without saying that the many firms contributing to New Jersey's billion dollar annual chemical business are heavily engaged in research. Their laboratories are well equipped and numerous. To mention just a few, there are important laboratories at American Cyanamid in Bound Brook, Nopco Chemical Company in Harrison, Allied Chemical & Dye Corporation in Morris Township, General Aniline & Film Corporation at Grasselli, Heyden Chemical Corporation at Fords and Garfield, J. T. Baker Chemical Company in Phillipsburg. There are many others; these are merely representative.

Equally exciting is the future facing the electronics industry, and here New Jersey probably is also the national leader. The state has been out in the forefront of electronics development traditionally, at least partially because the Signal Corps center has been located in Monmouth County since 1917. Obviously

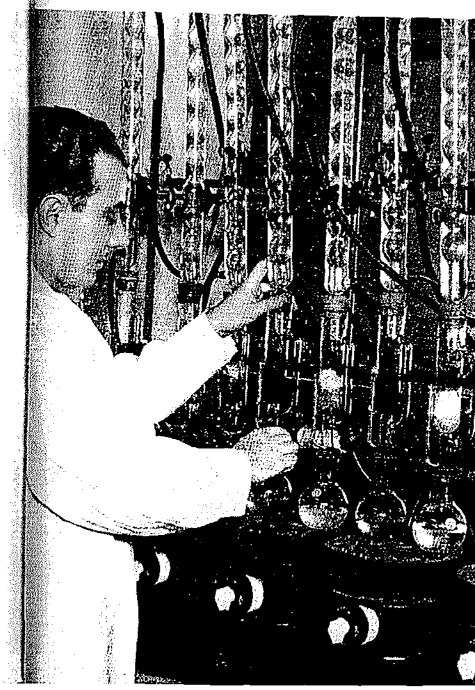
much communications know-how emanated from old Camp Vail and its latter-day successor, Fort Monmouth.

Fort Monmouth still is the national center of secret army communications research, and its presence has given impetus to several private laboratories in Monmouth County. Much electronics research also is carried on by private industry in many state locations and New Jersey has several of the world's best-known electronics-linked research installations.

RCA's David Sarnoff Research Center at Princeton is world famous for its work in radio, television, acoustics, electronic tubes and most other phases of electronics. The laboratory was established in 1942 to draw RCA research together in one spot; today more than a thousand persons work in the huge center.

Much of RCA's development of color television took place at Princeton, and recently the center displayed a method of recording TV pictures on magnetic tape in both black and white and color. The center also announced this year an atomic electric battery, about the size of a cigaret filter, which converts atomic energy directly and simply into small but

One of tests to develop better fibers at Botany Mills.



Electrical "mouse" seeks "cheese" in Bell Labs maze.

useable quantities of electric energy.

Allen B. DuMont Laboratories is important in electronics, naturally, both for past developments and for work still in the blue-print stage at the research facilities in Passaic. Not far away, in Nutley, Federal Telephone and Radio Company's "Laboratory in the Sky" is a major link in the world-wide chain of experimental laboratories maintained by I.T.&T.

Today, behind the closely guarded doors of Federal's laboratory, hundreds of scientists and technicians are at work on problems pertaining to radar, television, microwave communications and many classified projects. The "Laboratory in the Sky"—a 300-foot aluminum-sheathed microwave tower—is the first structure of its kind ever built and dedicated to telecommunications electronics.

Yet, of all the research laboratories in New Jersey, and possibly in all the United States, none is better known than Bell Telephone Laboratories in Murray Hill. Opened in 1942, Bell's Murray Hill research work now covers 450,000 square feet of space and occupies the time and thought of nearly 3,500 persons.

As should be expected, the work at Murray Hill features communications, since the Laboratories are jointly owned by A.T.&T. and Western Electric. Research into everything from telephone handsets to wire and from switchboards to telephone poles goes relentlessly on. However, research knows no limited bonds, and from collateral developments have come much of the fame accruing to Murray Hill.

One of the best-known research finds of modern times is the transistor, invented at Murray Hill by a team of three scientists. The tiny, rugged transistor came out of persistent and pure research, and since Bell Laboratories first announced the device in 1948 the transistor has been found capable of performing efficiently nearly all the functions of an ordinary vacuum tube.

Murray Hill scientists continue to explore nearly every avenue of communications and sound. The transistor is widely used in telephonic communications, but manufacturing licenses have made it available for a wide range of electronics use. From Murray Hill will continue to come better telephones and switchboards, better electronics devices, better sight and sound. Possibly even a better mousetrap may come from Murray Hill. Bell Laboratories in 1952 developed a better electrical "mouse," a two-inch bar magnet with copper whiskers. The "mouse" can quickly solve more than 1,000,000 different mazes to find his "cheese," and he's highly useful routing calls through complex telephone switchboards.

Bell Telephone Laboratories have been in New Jersey since 1926, coming first to a small laboratory in Whippany from where the first television program was broadcast to New York in 1927. The Whippany phase of Bell Laboratories work seldom gets the headlines alloted to Murray Hill, since most of the work of the 1,500 Whippany employees is highly classified. It has been announced, however, that the Whippany laboratory developed the electronic "brain" of NIKE, the anti-aircraft missile with the uncanny ability to track down and destroy a maneuvering enemy plane.

The future of the world seems linked to nuclear fission and New Jersey is certain to play a continuing role, just as it did in the production of the first A-bomb. As an example, two scientists, searching for a better lamp filament in the Westinghouse Lamp Division at Bloomfield, developed pellets of pure uranium in 1922. Twenty years later, when three tons of uranium were needed for the Manhattan Project in 1942, Westinghouse scientists found ways of boosting uranium production at Bloomfield from a few ounces a day to 500 pounds daily.

Another vital World War II nuclear contribution came from the Princeton University campus, where in 1935 Professor Hugh Scott Taylor "boiled" seventy-five tons of water down to ten drops of heavy water containing one part of heavy hydrogen. Taylor and his co-workers labored around the clock in the Frick chemical laboratory at Princeton to produce heavy water for the Manhattan Project. The process is still used today.

Work on New Jersey college campuses is essential in the state's over-all research picture. Many highly specialized projects are in full swing at Princeton, Rutgers, Stevens and the Newark College of Engineering. The college researcher has one special advantage: he can usually pursue his research with only casual concern as to whether his work will mean the difference between dividends or no dividends.

The industrial world of the next decade or the next several decades will not find New Jersey wanting, since research really works in terms of tomorrow. It has been estimated that all national chemical sales in 1970 will find 60 per cent of their gross dollar value in products not even on the market today. The Sound Barrier has been only pierced, not riddled; there is much ahead there for the aeronautical industry. Petroleum research is aiming at new horizons. Atomic energy is seeping into wider New Jersey industrial usage today.

Research begets research, too. A new conception in the world of aerodynamics, for example, may call for a dozen new conceptions in allied fields. There is an interchange of thought (within patent limitations and government security regulations) among scientists, whose essential goal is truth rather than dollars. New Jersey's acknowledged research orbit is destined to attract even more research.

Industrial research today goes far beyond immediate profit, although quite naturally most business laboratory work must have its specific goals related to the balance sheet. However, a large portion of all industrial research workers engage in searches for basic truths which might or might not have dollar value. The well-run research laboratory knows when to stop research before it becomes a bottomless pit or a dry well, however.

Often basic research leads to important new discoveries through chance, through serendipity, the art of finding things you are not looking for. Edison, for example, "found" the phonograph while seeking a better means of recording telegraphic messages. Westinghouse scientists found an important atomic need while looking for a lamp filament. Recently, Esso Research Center researchers found SR-406, an extraordinary fungicide, while looking for an insecticide.

Researchers long since have proved their worth to industry, through benefitting mankind generally, through making stockholders happy specifically. Accordingly, researchers today get the best: excellent equipment, trained co-workers, universitylike buildings set among rolling hills. Not that all research work is carried on in the country air; as a matter of fact, Newark has fifty-seven research laboratories within its bounds, and if there is one thing Newark cannot claim, it is clean, fresh country air.

One important research element which gets virtually no public notice is the importance attached by scientists to the specialized libraries maintained by laboratories. Even the smallest laboratory maintains a minimum of 500 books, and Bell Telephone Laboratories has 45,000 catalogued books on its shelves. It's anybody's guess, but it is likely that close to 3,000,000 highly technical books are available to laboratory workers in New Jersey.

Industry ever worries about what the morrow will bring. No economist has yet made his mark by compounding the formula: industry plus research equals continuing prosperity. Yet, it seems sound; industry plus research pulled many a firm out of the Great Depression. The corollary, of course, is that industry divorced from research must collapse.

Accordingly, with The-World-At-The-Crossroads seeking a young man who can build a better mousetrap, it is economically comforting to know that New Jersey has the research know-how. Tomorrow can't help but be better, whether or not you hold stock in an industrial concern.

PESTICIDES—1955

Economic Poisons

Inspection Series 63

May, 1956

NEW JERSEY AGRICULTURAL EXPERIMENT STATION
RUTGERS UNIVERSITY—THE STATE UNIVERSITY OF NEW JERSEY
NEW BRUNSWICK, NEW JERSEY

LINDANE – BENZENE HEXACHLORIDE CONT'D

Station Number	Manufacturers	Gamma Isomer Guaranteed	Gamma Isomer Found	Total BHC Guaranteed	Total BHC Found
78	Orchard Brand G-12 BHC Spray Powder	12.00	12.40		
	Baugh & Sons Co., Philadelphia, Penna.				
424	Baugh's 1% Lindane Dust	1.00	1.10		
	Bonide Chemical Co., Utica, N.Y.				
765	Bonide Aphis Dust	1.00	1.10		
767	Bonide Bondane	5.00	5.60		
	California Spray Chemical Corp., Richmond, Calif.				
94	Gamtox 10 Wettable	10.00	10.80		
135	Gamtox Wettable No. 100	10.00	10.60		
229	Isotox Spray No. 200	20.00	21.30		
296	Isotox Liquid Dairy Spray	20.00	21.60		
358	Ortho Isotox 25 Wettable	25.00	26.10		
749	Isotox Liquid Dairy Spray	20.00	21.20		
	Chipman Chemical Co., Inc., Bound Brook, N.J.				
383	Chipman Lindane W-25	25.00	25.40		
	Coop. G.L.F. Exchange, Inc., G.L.F. Soil Bldg. Service, Ithaca, N.Y.				
5	G.L.F. 20% Lindane Crop Spray	20.00	20.10		
194	G.L.F. Dust #24	1.00	0.90		
242	G.L.F. Dust #24 G	1.00	1.20		
539	G.L.F. Residual Barn Spray	20.00	20.20		
	William Cooper & Nephews, Inc., Chicago, Ill.				
615	Pulvex Anti-Scratch Flea Powder	0.50	0.60		
	Esso Standard Oil Co., Linden, N.J.				
680	Flit with Lindane	0.10	0.15		
	Food Machinery & Chemical Corp., Niagara Chem. Div. Middleport, N.Y.				
73	Niagara BHC 10 Spray	10.00	10.90		
221	Niagara BHC 1.2 Dust	1.20	1.10		
228	Niagara Lindane 1 Dust	1.00	1.10		
	The Garden Supply Co., Trenton, N.J.				
938	Blue Brand 0.75% Gamma Isomer of BHC Dust	0.75	1.20		
	Happy Jack, Inc., Snow Hill, N.C.				
510	Happy Jack Flea - Tick Powder	1.00	0.80		
	Holly Chemical Co., Mt Holly, N.J.				
250	Holco Brand 1% Lindane Dust	1.00	1.40		
	Janitorial Supply Co., Wallington, N.J.				
1061	Janisan Lindascide	100.00	100.00		
	Lirlo Chemical Co., Vineland, N.J.				
210	Lindane 1 Dust	1.00	1.10		
	Miller Chemical & Fertilizer Corp., Baltimore, Md.				
180	Miller's 1-1/2% Gamma BHC Dust	1.50	1.60		
183	Miller's 1-1/2% Lindane Dust	1.50	1.40		
	Neil C. Miller, Penns Grove, N.J.				
189	Miller's Millelind	1.50	2.70		
796	Miller's Milledane	1.50	2.10		
	Parkhurst Farm Supply, Hammonton, N.J.				
123	Parkhurst's Isotox Dust	1.00	1.80		
153	Parkhurst's 1% Ben Dust	1.00	1.20	0.00	6.90
	Pennsylvania Salt Mfg. Co., Philadelphia, Penna.				
117	Pennsalt Ill-Gam E-20	20.00	21.30		
	Pittsburgh Plate Glass Co., Corona Chem. Div. Moorestown, N.J.				
169	Corona 1% BHC Dust	1.00	1.10		
254	Corona BHC	10.00	9.90		
	B. G. Pratt Co., Paterson, N.J.				
578	Pratt's 5% Lindane	5.00	5.00		
	Ralston Purina Co., St. Louis, Mo.				
643	Purina Poultry Insecticide	1.50	1.30		
	Rice & Caruso Farm Supply, Inc., Hammonton, N.J.				
136	Lindane Dust	1.00	0.90		
141	BHC-6 W	6.00	6.20		
144	BHC Dust	0.75	0.70		
	Jacob Rubinoff Co., Vineland, N.J.				
310	Rubinoff Roost Paint	1.50	1.90		
	Seacoast Laboratories, Inc., New York, N.Y.				
44	Twin Light Gam Dust No. 1	1.00	1.20		
543	Twin Light Lindane 25% Wettable Powder	25.00	26.40		
	The Terre Co., Rochelle Park, N.J.				
464	Lindane 1% Dust	1.00	1.10		
470	BHC Dust	1.00	0.70		
	[illegible].P. Thomas & Son Co., Camden, N.J.				
[illegible]	I.P.T. 1% Gamma BHC Dust	1.00	0.90		
17[illegible]	I.P.T. Lindane Dust	1.00	1.10		
	Vineland Laboratories, Inc., Vineland, N.J.				
67[illegible]	Vineland 20% Lindane Concentrate	20.00	23.30		

LINDANE – BENZENE HEXACHLORIDE CO[illegible]

Station Number	Manufacturers	Gamma Isomer Guaranteed	Gamma Isomer Found	Total BHC Guaranteed	Total BHC Found
	Andrew Wilson, Inc., Springfield, N.J.				
989	Wilson's Linmite	6.00	6.40		
	M. A. Wright Co., Brooklyn, N.Y.				
628	Tic-Ro	0.50	0.70		

LINDANE – THIRAM

Station Number	Manufacturers	Lindane Guaranteed	Lindane Found	Thiram Guaranteed	Thiram Found
	Coop. G.L.F. Exchange, Inc., G.L.F. Soil Bldg. Service, Ithaca, N.Y.				
601	G.L.F. Combination Seed Treatment #1	2.70	3.20	10.70	8.50
	E. I. duPont de Nemours & Co., Inc., Wilmington, Del.				
802	DuPont I & D Seed Protectant	14.00	13.80	56.00	62.20

MALATHION

Station Number	Manufacturers	Malathion Guaranteed	Malathion Found
	Acme Quality Paints, Inc., Detroit, Mich.		
781	Acme 50% Malathion	50.00	57.00
	Allied Chemical & Dye Corp., General Chem. Div. New York, N.Y.		
128	25% Malathion Wettable Spray Powder	25.00	24.80
407	Orchard Brand Malathion 50% Emulsifiable Concentrate	50.00	48.80
	Baugh & Sons Co., Philadelphia, Penna.		
354	Baugh's 4% Malathion Dust	4.00	3.20
	Bonide Chemical Co., Utica, N.Y.		
751	Bonide Malethox	50.00	54.20
	California Spray Chemical Corp., Richmond, Calif.		
186	Ortho Malathion 5 Spray	55.70	56.40
890	Ortho Fly Killer Dry Bait	2.00	1.80
	Chamberlin & Barclay, Inc., Cranbury, N.J.		
380	Old Reliable Agricultural Dust Mixture 5% Malathion Insecticide Dust	5.00	4.20
	Coop. G.L.F. Exchange, Inc., G.L.F. Soil Bldg. Service, Ithaca, N.Y.		
240	G.L.F. Dust #30	5.00	3.40
344	G.L.F. 50% Malathion Emulsifiable	55.00	62.40
	E.I. duPont de Nemours & Co., Inc., Grasselle Chem. Dept., Wilmington, Del.		
740	DuPont Aphid & Mite Spray	50.00	50.70
	Food Machinery & Chemical Corp., Niagara Chem. Div. Middleport, N.Y.		
226	Niagara Malathion 4 Dust	4.00	4.00
	Geigy Chemical Corp., Geigy Agricultural Chemical, New York, N.Y.		
291	Geigy 4% Malathion Dust	4.00	3.60
	Lirlo Chemical Co., Vineland, N.J.		
315	Malathion 4 Dust	4.00	3.70
	Miller Chemical & Fertilizer Corp., Baltimore, Md.		
56	25% Malathion Wettable Powder	25.00	24.90
747	Miller Hy-Tox Insect Dust	4.00	2.80
900	Miller Hy-Tox Fly Bait	1.00	2.40
	Newton Chemical & Supply Co., Bridgeville, Del.		
212	Newton's 4% Malathion Dust	4.00	4.20
	Parkhurst Farm Supply, Hammonton, N.J.		
155	Parkhurst Malathion Dust	4.00	3.80
	Pennsylvania Salt Mfg. Co. of Washington, Tacoma, Wash.		
806	Penco Malathion W-25	25.00	26.20
	Pittsburgh Plate Glass Co., Corona Chemical Div. Moorestown, N.J.		
272	Corona Malathion 25% Wettable Powder	25.00	25.90
	B. G. Pratt Co., Paterson, N.J.		
575	Pratt's 50% Malathion Spray	50.00	51.90
	Ralston Purina Co., St. Louis, Mo.		
166	Purina Fly Bait (Dry Killer)	2.00	2.10

EXXON COMPANY, U.S.A.
POST OFFICE BOX 222 • LINDEN, NEW JERSEY 07036

REFINING DEPARTMENT
BAYWAY REFINERY

J.C. HOOK
MANAGER

August 29, 1985

Exxon Bayway Refinery
Landfarm Closure Plan

Mr. John J. Trela, Chief
Bureau of Ground Water Discharge Permits
Department of Environmental Protection
32 East Hanover Street
CN 029
Trenton, New Jersey 08625

RECEIVED
SEP 1 1985
Dept. Environmental Protection
Division Water Resources
Bureau Ground Water Discharge Permits

Dear Mr. Trela:

Enclosed is the closure plan for the Exxon USA, Bayway Refinery Land Treatment Unit which was requested by your office on July 15, 1985. As previously agreed, a post-closure plan will be submitted under separate cover at a later date upon request by your office.

The closure plan is submitted in accordance with applicable state and federal regulations. For convenience, a modified list of applicable NJAC and 40 CFR 264, 270 standards are included for reference. Exxon has also agreed to perform testing outlined in the July 15 correspondence by your office. Specifically, EP toxicity, heavy metal, and oil and grease analyses will be performed on landfarm soil samples during the closure period. The closure plan does not cover a description of hydrological conditions at the site or post-closure ground-water monitoring details which will be submitted with the post-closure plan at a later date.

Four copies of the closure plan are enclosed. Should you have any questions regarding the closure plan, please contact W. L. Taetzsch, (201) 474-7585 or Sherman Brown, (201) 474-6390.

Very truly yours,

J. C. Hook

JCH/vob
Attachments

TABLE OF CONTENTS

LIST OF EXHIBITS

CROSS - REFERENCE LISTING OF CLOSURE PLAN APPLICATION TO NJAC 7:14 A, 26

	7:14 A		7:26-9										7:26 - 12.2			
	4.7	6.15	4	5	6	7	8	9	10	11	12	13	(d)	(e)	(i)	(j)
FACILITY DESCRIPTION																
1. General														(1)		
2. Topographic Map														(13)		
CLOSURE																
1. Closure Plan	(m)						X							(16)		
2 Notice in Deed								X						(17)		
3. Closure Cost Estimate									(e)					(18)		
4. Financial Assurance for Closure									(f)		X			(18)		
5. Liability Requirements												X		(20)		

CROSS - REFERENCE LISTING OF CLOSURE PLAN APPLICATION TO 40 CFR 264, 270

	40 CFR 264												40 CFR 270					
	.13	.14	.15	.16	.17	.18	C	D	F	G	H	M	.10	.11	.13	.14 (b)	.14 (c)	.21
FACILITY DESCRIPTION																(1)		
1. General																(19)		
2. Topographic Map																(11)		
CLOSURE/POST-CLOSURE																		
1. Closure Plan										.112		.280				(13)		
2. Notice in Deed										.120						(14)		
3. Closure Cost Estimate											.142					(15)		
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5. Liability Requirements											.147					(17)		

CLOSURE PLAN CHECKLIST

CLOSURE AND POST-CLOSURE REQUIREMENTS

		Provided (Y/N)	Adequate (Y/N)	Not Applicable	Page # Exhibit #
1	Closure plans				4
1a	Closure performance standard	y			4
1b	Partial and final closure activities	y			5
1c	Maximum waste inventory	y			5
1d	Inventory removal, disposal or decontamination of equipment	y			5
1d(1)	Closure of containers			x	
1d(2)	Closure of tanks			x	
1d(3)	Closure of waste piles			x	
1d(4)	Closure of surface impoundments			x	
1d(5)	Closure of incinerators			x	
1d(6)	Closure of land treatment facilities				
1d(6)(a)	Continuance of treatment	y			5
1d(6)(b)	Vegetative cover	y			6
1e	Closure of disposal units			x	
1e(1)	Disposal impoundments			x	
1e(1)(a)	Elimination of liquids			x	
1e(1)(b)	Waste stabilization			x	
1e(2)	Cover design			x	
1e(3)	Minimization of liquid migration			x	
1e(4)	Maintenance needs			x	
1e(5)	Drainage and erosion			x	
1e(6)	Settlement and subsidence			x	
1e(7)	Cover permeability			x	
1e(8)	Freeze/thaw effects			x	

		Provided (Y/N)	Adequate (Y/N)	Not Applicable	Page # Exhibit #
1f	Schedule for closure	y			6, Exhibit 7
1g	Extensions for closure time	y			7
2	Post-closure plan				
2a	Inspection plan			x	
2b	Monitoring plan			x	
2c	Maintenance plan			x	
2d	Land treatment	y			
3	Notice in deed	y			7
4	Closure cost estimate	y			7, Exhibit 8
5	Financial assurance mechanism for closure				8, Exhibit 9
5a	Closure trust fund	y			8, Exhibit 9
5b	Surety bond				
5b(1)	Surety bond guaranteeing payment into a closure fund			x	
5b(2)	Surety bond guaranteeing performance of closure			x	
5c	Closure letter of credit	y			8, Exhibit 9
5d	Closure insurance	y			8, Exhibit 9
5e	Financial test and corporate guarantee for closure	y			8, Exhibit 10
5f	Use of multiple financial mechanisms			x	
5g	Use of financial mechanism for multiple facilities			x	
6	Post-closure cost estimate			x	
7	Financial assurance mechanism for post-closure care				

		Provided (Y/N)	Adequate (Y/N)	Not Applicable	Page # Exhibit #
7a	Post-closure trust fund			x	
7b	Surety bond				
7b(1)	Surety bond guaranteeing payment into a post-closure trust fund			x	
7b(2)	Surety bond guaranteeing performance of post-closure care			x	
7c	Post-closure letter of credit			x	
7d	Post-closure insurance			x	
7e	Financial test and corporate guarantee for post-closure care			x	
7f	Use of multiple financial mechanisms			x	
7g	Use of a financial mechanism for multiple facilities			x	
8	Liability requirements				8
8a	Coverage for sudden accidental occurences				
8a(1)	Endorsement or certification	y			8, Exhibit 10
8a(2)	Financial test for liability coverage	y			8, Exhibit 10
8a(3)	Use of multiple insurance mechanisms			x	
8b	Coverage for nonsudden accidental occurences				8, Exhibit 10
8b(1)	Endorsement or certification	y			8, Exhibit 10
8b(2)	Financial test for liability coverage	y			8, Exhibit 10
8b(3)	Use of multiple insurance mechanisms			x	
8c	Request for variance			x	
9	State mechanisms				
9a	Use of state-required mechanism			x	
9b	State assumption of responsibility			x	

FACILITY DESCRIPTION

This closure plan pertains to the Bayway Landfarm, which was operated, in part, for the treatment of oily wastes (API separator bottoms) generated at the Refinery which are listed as hazardous wastes under RCRA. This section presents a brief general description of the Bayway Refinery and the landfarm, which complies with section 271.14 of RCRA and pertinent requirements of Part 264 of RCRA. This description also meets the requirements of New Jersey hazardous waste regulations under NJAC 7:26-12.

1. GENERAL DESCRIPTION

1a. Facility Name and Location

The Bayway Refinery is situated on a 1200-acre tract located in the City of Linden, Union County, New Jersey. The Refinery is owned and operated by Exxon Company, U.S.A. a division of Exxon Corporation, and began initial operation on January 2, 1909. Site coordinates are latitude North 40°-38'-16.8" and longitude West 74°-1.3'-12.0" (UTM Coordinates Zone 18 - Northing 4,498,660.221 meters, Easting 565,958.802 meters). The reference location is the intersection of Brunswick Avenue and Railroad Avenue within the Refinery. The Bayway office building is located at 1400 Park Avenue.

The main body of the Refinery is situated with U.S. Route No. 1 along the western side and Wood Avenue on the southern side of the property. Interstate No. 278 passes through the northern boundary while the New Jersey Turnpike passes between the main body of the plant and the waterfront area located on the eastern side of the property. The waterfront area which contains the Refinery's tanker docks and barge piers is bounded on the east by the Arthur Kill, a major ship channel which separates New Jersey from Staten Island, New York. The outlying tank fields are located to the west and south of the Refinery proper.

Exhibit 1 illustrates the approximate location of the facility on a map of the State of New Jersey. Exhibit 2 illustrates the area of the site and the immediately surrounding area. Exhibit 3 presents a detailed plan of the Refinery and its structures.

The mailing address of the facility is:

Exxon Company, U.S.A.
P. O. Box 222
Linden, New Jersey 07036

The EPA I.D. Number for the site is NJD062037031. The contact for hazardous waste management activities at the site is:

Environmental Coordinator
P. O. Box 222
Linden, NJ 07036
(201) 474-7585

2. HAZARDOUS WASTE FACILITY DESCRIPTION AND TOPOGRAPHIC MAP

The Bayway Landfarm is located in the City of Linden, New Jersey, within the 1200-acre tract which constitutes the Bayway Refinery, Chemical Plant, and Domestic Trade Terminal (see Exhibit 3). Total area of the landfarm is approximately 8 acres, with approximately 6 acres of effective land treatment area contained within the runoff control dikes. Exhibit 4 presents a topographic map of the landfarm.

The landfarm is located over an old landfill, which was covered with approximately 3 feet of clay material. Soil was brought into the area, to cover the clay, and to provide an appropriate medium for microbial degradation of waste materials.

The Bayway Landfarm was used primarily as a hazardous waste treatment facility. Since April 1, 1979 when Bayway's National Pollution Discharge Elimination System (NPDES) Permit became effective, the landfarm has been used primarily for the disposal of API separator bottoms, sewer cleanings, and oil contaminated soil from excavations. Occasionally, as landfarm conditions permitted, tank bottoms, and spill cleanings, were applied to the landfarm. [redacted]

The treatment procedures for the landfarm were relatively simple. Oily wastes were spread in a light layer on top of the soil. A harrow was used to mix the oily solids and the soil with air. Natural bacteria in the soil broke down the oil using oxygen from the air and formed carbon dioxide, water, energy, and more bacteria. Periodically, nutrients for the bacteria, in the form of fertilizer, were applied to the soil to promote good oxidation of the oil. Lime was applied to the landfarm, if needed, to keep the pH high to immobilize the heavy metals. This procedure was conducted to prevent the metals from leaching into the surrounding water. Landfarming has been in use by Exxon since 1954 and at Bayway since 1973. During this time, landfarming has been shown to be a reliable, practical, environmentally sound treatment process for oily wastes.

The only hazardous waste which was treated on the landfarm was API separator sludge. This waste is listed as hazardous wastes under RCRA, with waste identification number K051. API separator sludges are generated in the refinery waste water treatment plant. The quantity of API separator sludge treated in the landfarm ranged from about 11,000 - 19,000 m^3/year (12,000 - 21,000 tons/year). Some non-hazardous wastes (e.g., oil-contaminated soils) were also treated on the landfarm. The volume of these wastes was low when compared to API separator sludges.

Hazardous by state Regs.

CLOSURE REQUIREMENTS

This section addresses the closure plan for the Bayway Refinery land treatment unit. This section also contains financial assurance statements for closure plus liability statements for coverage of accidental occurrences. The information in this section is required under 40 CFR 270.14 (b) (13-17)/NJAC 7:26 - 12.2 (e) (16-20) and must meet the requirements of 40 CFR 264.110-.151, 264.280/NJAC 7:26-9.8 - 9.13.

1. CLOSURE PLAN

This subsection provides details on the closure plan and schedule for the refinery land treatment unit. Briefly, the closure plan involves continuance of normal operations following the last application of waste, testing to determine hazard of remaining material, revegetation of the site, and decontamination of equipment.

?, Can they?

1a. Performance Standard

The closure plan is designed to minimize the need for post-closure maintenance and the possibility of hazardous wastes reaching the environment. Continuance of treatment after the last waste application and subsequent testing ensures that no hazardous material remains on-site following closure. Hence, hazardous wastes will not be available to threaten human health or the environment. The site will be revegetated with a suitable cover (i.e., 6-8 inches of top soil and seed) which will provide erosion and dust control.

Can't

The specific type of vegetative species will be dependent on the need to establish a clay cap over the landfarm. ~~A study will be conducted during the next six months to determine the need for a cap.~~ The primary objective of the study will be to conduct a water balance analysis in order to determine the relative impact of a cap in reducing leachate flow through the landfarm and the landfill which underlies the site. A field study will soon be implemented to determine the vegetative species most suitable for the Bayway landfarm. must be in post-closure plan

1b. Partial and Final Closure

Partial closure of the land treatment unit is not anticipated.

1c. Maximum Waste Inventory

The regulations require an estimate of the maximum waste inventory in storage or in treatment during the life of the facility. [redacted] During the active operation of the land treatment unit, approximately 12,000 cubic meters of waste were "in treatment" at the facility.

1d. Inventory Removal/Disposal or Decontamination of Equipment

Application equipment (vacuum and dump trucks) will be thoroughly washed and the wash water disposed on the land treatment areas. Once tilling ceases the tilling equipment will be cleaned, and the water allowed to drain into the refinery sewer system.

1d (6) (a) Continuance of Treatment

- o Waste application to the land treatment unit ceased August, 1984. Tilling, nutrient addition and PH adjustment have continued for one year. All operations will continue for approximately one additional year or until waste degradation has apparently ceased as determined by the oil and grease content in the soil. Oil and grease has been measured quarterly for one year (Exhibit 5) and will continue on a quarterly basis. [redacted] Also E.P. toxicity tests have been conducted on soil samples quarterly for one half year. [redacted] One additional EP toxicity test will be conducted on soil samples obtained during the next quarterly sampling period. EP toxicity analysis will be terminated if results show the soil to be non-hazardous. [redacted]

what abo' unsat. zon' soil pore liquid?

- o The removal of collected rainwater will be continued to minimize run-off of potential hazardous constituents from the treatment zone. Furthermore, the dikes will be maintained for both flood and run-off control. Removal to where?
- o Water will be applied, if needed during dry weather, to minimize wind dispersal. Wind dispersal of land treatment soil has not been a problem in the past.
- o Food-chain crops will not be grown on the land treatment site during closure, or post-closure
- o Normal groundwater monitoring will be continued as well as the soil sampling and analytical protocols previously discussed.
- o Ultimately, the dikes at the site will be removed, the landfarm soils revegetated, and the site regraded to 1-3% to provide proper drainage control → may not be able to.

1d (6) (b) Vegetative Cover

The site will be revegetated with a suitable, non-foodchain cover material to minimize soil erosion. [redacted]. This vegetative cover also will aid in wind dispersal control during post-closure. The species and variety selected for the vegetative cover will be determined by testing previously outlined.

1f. Schedule for Closure

Exhibit 7 contains a tracking schedule for the closure plan. [redacted] If not, operations will continue delaying the schedule for final closure of the site. In addition, the schedule for final closure may be further delayed if biodegradation ceases at a time not suitable for germination of a vegetative species. In accordance with NJAC 7:26-9.8 (k)(1), NJAC 7:14-4.7(m) 2, and 40 CFR 264.115, [redacted]

1g. Extensions for Closure Time

The regulations currently define the inititation of closure to be the last application of waste. Furthermore, the regulations [40 CFR 276.113 (b)/NJAC 7:26-9.8 (i)] require closure to be complete within 90 days. [redacted] Hence, an extension of the closure time to 27 months is requested. This includes the initial 24 months which the Refinery considers part of normal operation rather than true closure.

3. **NOTICE IN DEED**

A notice in the property deed to the Refinery will be made in accordance with the provisions of 270.14(b)(14), 264.120, 264.117 (c), and 264.119.

4. **CLOSURE COST ESTIMATES**

The current closure cost estimates for the land treatment unit is $565,000 (1985 dollars). Exhibit 8 contains a breakdown of these costs. This cost estimate will be updated annually in the second quarter by multiplying by the appropriate inflation factor derived from the U.S. Department of Commerce Implicit Price Deflator indices.

The Refinery considers the 24-month period following final application to be part of treatment operations rather than closure. All costs of normal operations and monitoring during this period are allocated to operating expenses rather than closure. Closure expenses begin with the Pre-closure sampling.

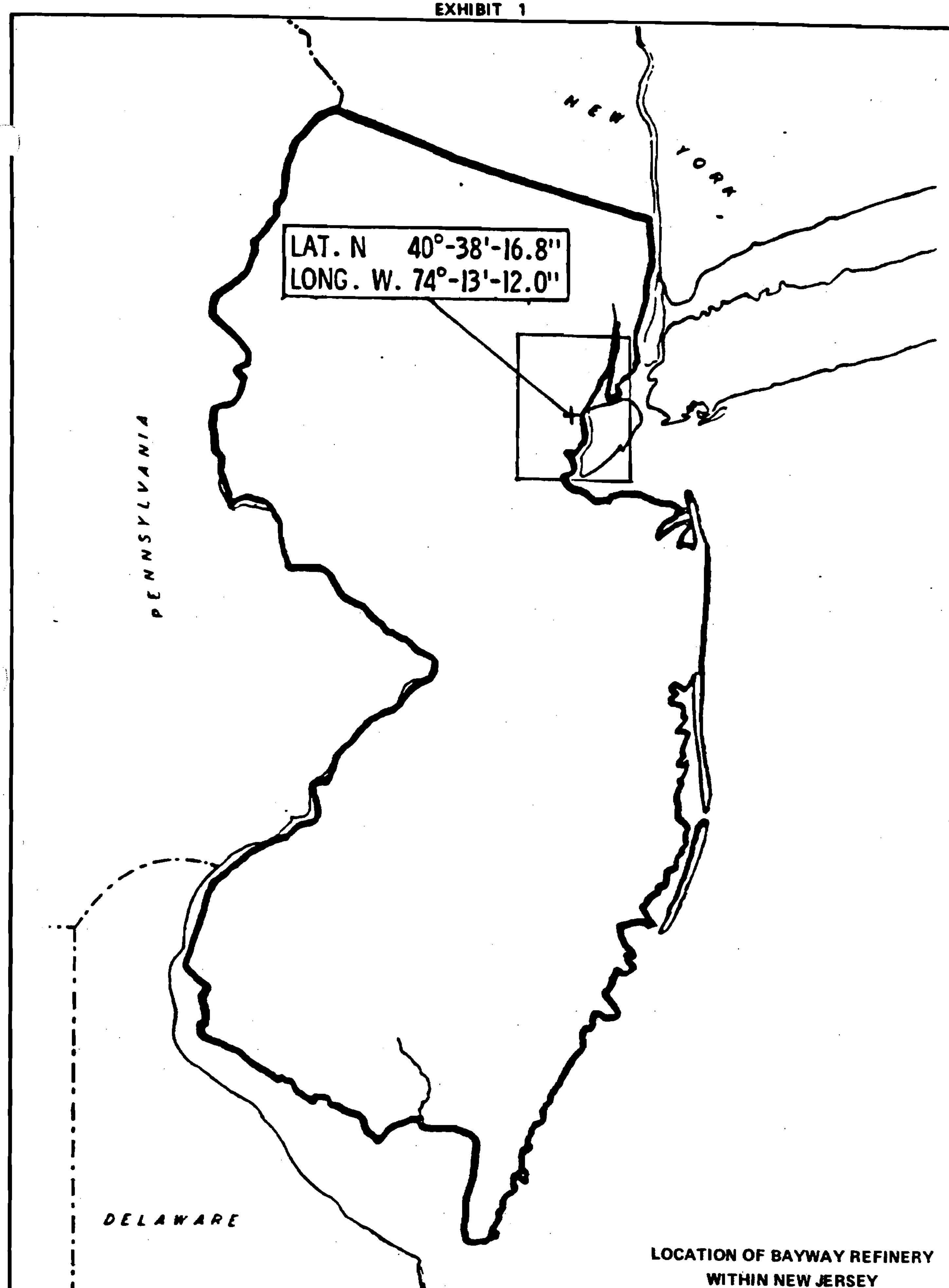
5. **FINANCIAL ASSURANCE MECHANISM FOR CLOSURE**

Financial assurance to cover the above cost estimate is via an Irrevocable Letter of Credit with the First Fidelity Bank of New Jersey (formerly First National State Bank). The Trustee is the First Fidelity Bank (formerly First National State Bank) of New Jersey. Exhibit 9 contains copies of the Letter of Credit and the Trust Agreement. Note that the amount of the Letter of Credit covers both closure and post-closure.

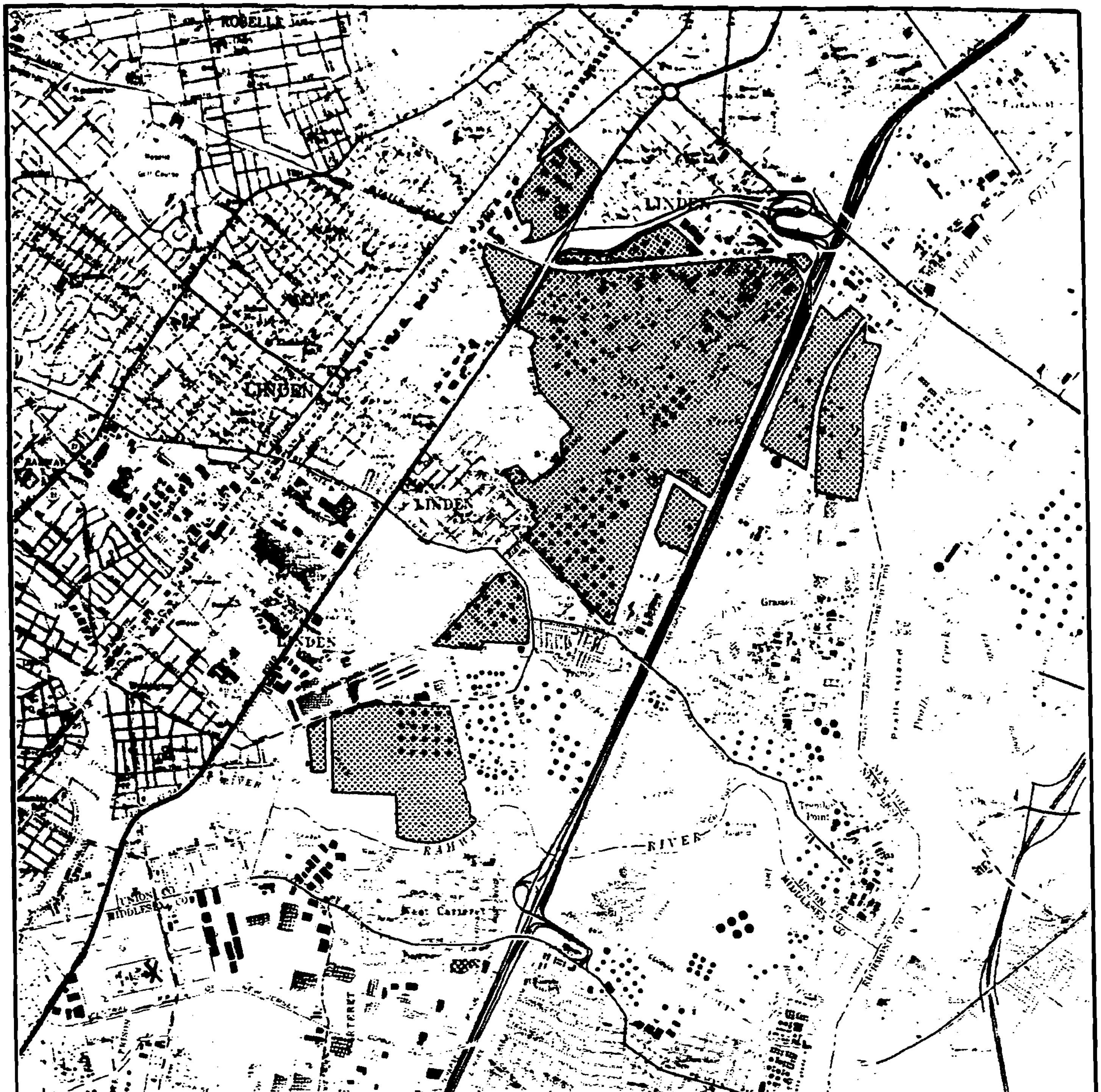
8. **LIABILITY REQUIREMENTS**

Exxon has chosen the financial test method for its liability coverage for the land treatment unit at the Bayway Refinery. Exhibit 10 contains photocopies of correspondence which has been previously submitted to the New Jersey Department of Environmental Protection. The letter dated April 24, 1985 signed by the Treasurer of Exxon Company, U.S.A. is submitted to provide liability coverage for the hazardous waste facilities at the Bayway Refinery in accordance with N.J.A.C. 7:26-9., 13.

EXHIBIT 1



LOCATION OF BAYWAY REFINERY
WITHIN NEW JERSEY



MAP SOURCE:
USGS MAPS, 7.5 MINUTE SERIES (TOPOGRAPHIC)
ARUTHER KILL, ELIZABETH, PERTH AMBOY, AND
ROSELLE QUADRANGLES, NEW YORK AND NEW JERSEY

LEGEND

INDICATES SITE LOCATION

N

0 2000 4000 6000 FT

SCALE

SITE LOCATION MAP

WOODWARD—CLYDE CONSULTANTS
CONSULTING ENGINEERS, GEOLOGISTS AND ENVIRONMENTAL SCIENTISTS
WAYNE, NEW JERSEY

DR. BY: DRS	SCALE: AS SHOWN	PROJ. NO.: 84C4040
CK'D. BY: DH	DATE: 27 MAR 1984	FIG. NO.: B2

EXHIBIT 2


MAP OF
BAYWAY REFINERY
EXXON COMPANY, U.S.A.
CITY OF LINDEN
UNION COUNTY, N.J.
EXXON
40 ACRE TANK FIELD
BAYWAY LANDFARM
RAHWAY RIVER
ARTHUR KILL
STATEN ISLAND

EXHIBIT

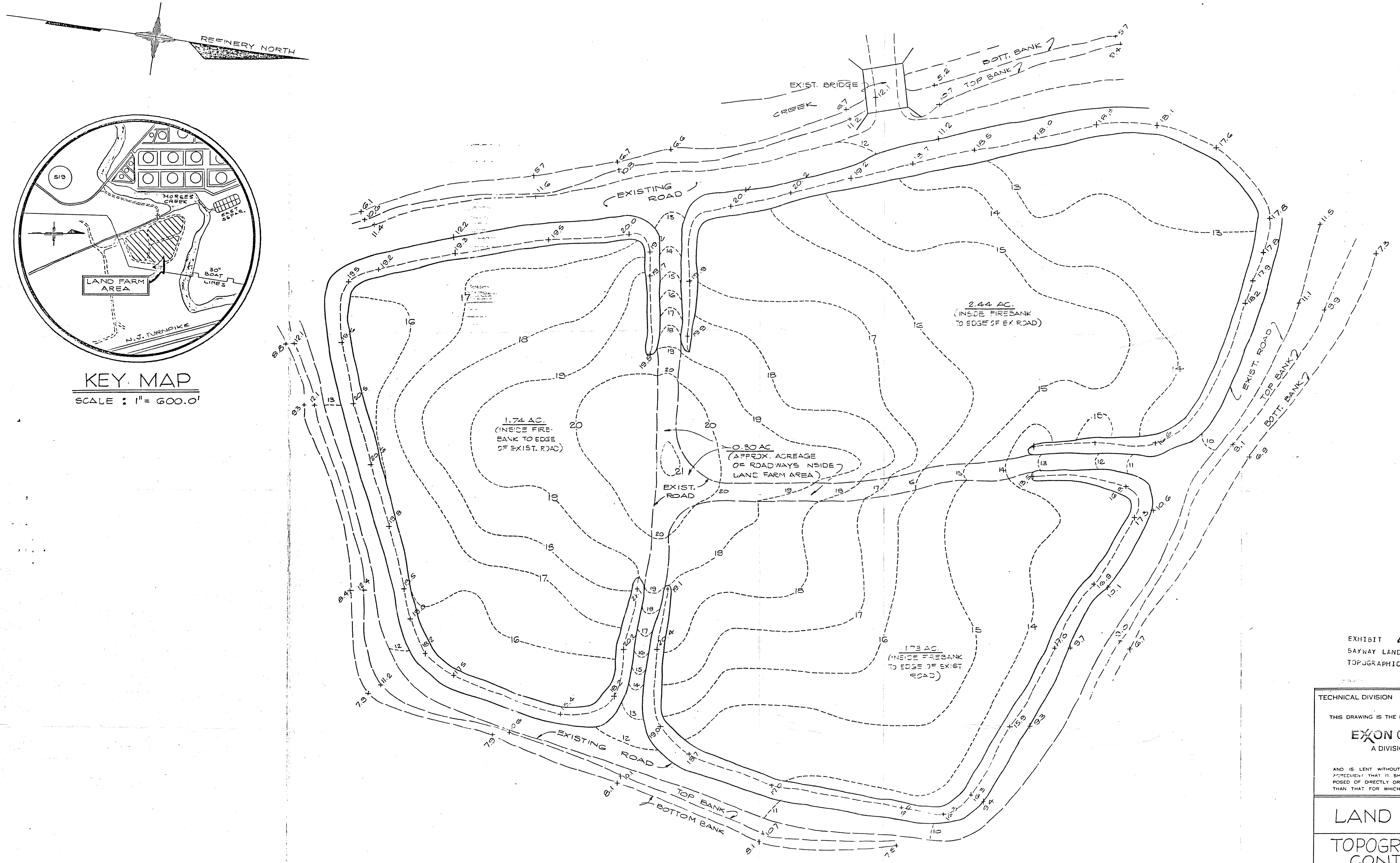


EXHIBIT 4
BAYWAY LANDFARM:
TOPOGRAPHIC SURVEY CONTOUR MAP

NOTE:
ELEVATIONS REFER TO BAYWAY REFINERY DATUM, TO CONVERT TO STATE DATUM SUBTRACT 2.35'

TECHNICAL DIVISION — BAYWAY REFINERY, LINDEN, NEW JERSEY

THIS DRAWING IS THE PROPERTY OF:

EXXON COMPANY, U.S.A.
A DIVISION OF EXXON CORPORATION
REFINING DEPARTMENT

LAND FARM AREA

TOPOGRAPHIC SURVEY CONTOUR MAP

DRAWING	DATE	APPROVAL	DATE
SURVEY G.J.F./ S.S. HUNTER	10/83	MECHANICAL DESIGN	
DRAWN G.N. FITZGERALD	3/6/84	PROJ. ENGINEER	
CHECKED E.G. SAFIR III	3/7/84	OPERATING DEPT.	
GROUP SUPERVISOR			

SCALE	DRAWING NUMBER	SHEET	REV NO
1" = 40'	17-76AA	1 OF 1	0

REV	DRAWN	CHK'D	DATE
7			
6			
5			
4			
3			
2			
1			

EXHIBIT 5

OIL AND GREASE TEST RESULTS

INTERNATIONAL
HYDRONICS CORPORATION

P.O. Box 243
Rocky Hill, N.J. 08553
Phone: (609) 921-9216

Client: Tom Aruta
Exxon Co.-Bayway
P.O. Box 182
Linden, NJ 07036

Job Number: 84-548-3

Date: 12/13/84

Date Received: 12/3/84

Sample Identification:

3 Samples

Laboratory Analysis:

Landfarm Samples Rec'd. 12/3/84

	Northeast	Northwest	South
pH	6.75	5.56	6.75
Oil & Grease (%)	4.67	3.79	4.34

High?

By [signature]
Bruce S. Bruns
Mgr. of Lab Services

BSB/bb

INTERNATIONAL
HYDRONICS CORPORATION

P.O. Box 243
Rocky Hill, N.J. 08553
Phone: (609) 921-9216

Client: Tom Aruta
Exxon Co.-Bayway
P.O.Box 182
Linden, NJ 07036

Job Number: 84-370-3

Date: 9/25/84

Date Received: 8/15/84

Sample Identification:

3 Samples

Laboratory Analysis:

Landfarm Samples - 8/13/84

	Smith Quad	Northeast Quad	Northwest Quad
pH	7.03	7.67	7.33
% Oil & Grease	4.43	5.66	3.75
% Moisture	15.1%	19.1%	13.5%
Water Holding Capacity	45.2	44.5	48.5

By [signature]
Bruce S. Bruns
Laboratory Supervisor

BSB/bb

INTERNATIONAL
HYDRONICS CORPORATION

P.O. Box 243
Rocky Hill, N.J. 08553
Phone: (609) 921-9216

Client: Tom Aruta
Exxon Co.- Bayway
P.O. Box 182
Linden, NJ 07036

Job Number: 84-288-3

Date: 7/2/84

Date Received: 6/22/84

Sample Identification:

3 Samples

Laboratory Analysis:

Land Farm Samples Rec'd. 6/22/84

	South Quad	N.W. Quad	N.E. Quad
pH	6.80	7.24	6.78
% Moisture	9.98	14.56	15.2
% Oil & Grease(wet. wt.)	6.8	6.3	6.8

By Phillip M. Worby
Phillip M. Worby
Acting Laboratory Manager

PMW/bb

EXHIBIT 6

E.P. TOXICITY TEST RESULTS

HYDRONICS CORPORATION

P.O. Box 243
Rocky Hill, N.J. 08553
Phone: (609) 921-9216

Client: Tom Aruta
Exxon Co.-Bayway
P.O. Box 222
Linden, NJ 07036

Job Number: 85-347-3

Date: 7/31/85

Date Received: 7/8/85

Sample Identification:

3 Samples

Laboratory Analysis:

6/28/85 Land Farm Samples

		N.E.	N.W.
Corrosivity: (pH)		7.47	7.40
Ignitability:		not ignitable	not ignitable
Flash Point:	°F Closed Cup	>210	>210
Reactivity:	H_2O	non-reactive	non-reactive
	pH 2.00	non-reactive	non-reactive
	pH 12.50	non-reactive	non-reactive
	CN^-	0.83ppm detected	<0.5ppm detected
	H_2S	none detected	none detected
%Oil & Grease:		4.00	3.24
EP Toxicity: (Leachate)			
Arsenic	mg/l	<0.001	<0.001
Barium	"	<1	<1
Cadmium	"	<0.06	<0.06
Chromium	"	<0.05	<0.05
Lead	"	<0.08	<0.08
Mercury	"	<0.001	0.001
Selenium	"	<0.001	<0.001
Silver	"	<0.05	<0.05

INTERNATIONAL
HYDRONICS CORPORATION

P.O. Box 243
Rocky Hill, N.J. 08553
Phone: (609) 921-9216

Client: Tom Aruta
Exxon Co.-Bayway
P.O. Box 222
Linden, NJ 07036

Job Number: 85-347-3

Date: 7/31/85

Date Received: 7/8/85

Sample Identification:

3 Samples

Laboratory Analysis:

6/28/85 Land Farm Samples

		South
Corrosivity: (pH)		6.76
Ignitability:		not ignitable
Flash Point:	°F Closed Cup	>210
Reactivity:	H_2O	non-reactive
	pH 2.00	non-reactive
	pH 12.50	non-reactive
	CN^-	0.50 ppm detected
	H_2S	none detected
%Oil & Grease:		3.98
EP Toxicity: (Leachate)		
Arsenic	mg/l	<0.001
Barium	"	<1
Cadmium	"	<0.06
Chromium	"	<0.05
Lead	"	<0.08
Mercury	"	<0.001
Selenium	"	<0.001
Silver	"	<0.05

By R.B. Bruns

RBB/bb

NATIONAL
HYDRONICS CORPORATION

P.O. Box 243
Rocky Hill, N.J. 08553
Phone: (609) 921-9216

Client: Tom Aruta
Exxon Co.-Bayway
P.O. Box 222
Linden, NJ 07036

Job Number: 85-155-3

Date: 5/7/85

Date Received: 4/1/85

Sample Identification:

3 Samples

Laboratory Analysis:

Land Farm Samples - 3/28/85

		N.E. Quadrant	N.W. Quadrant	South Quadrant
Corrosivity:	(pH)	7.60	7.94	7.79
Ignitability:		not ignitable non-flammable	not ignitable non-flammable	not ignitable non-flammable
Flash Point:	°F Closed Cup	>200	>200	>200
Reactivity:	H_2O	not detected	not detected	not detected
	pH 2.00	not detected	not detected	not detected
	pH 12.50	not detected	not detected	not detected
	CN^-	>1.1ppm	>0.2ppm	10.9ppm
	H_2S	not detected	not detected	not detected
% Oil & Grease:		5.78	4.61	5.56
EP Toxicity:	(Leachate)			
Arsenic	mg/l	0.006	0.005	0.01
Barium	"	<0.3	<0.3	<0.3
Cadmium	"	<0.06	<0.06	<0.06
Chromium	"	<0.06	<0.06	<0.06
Lead	"	<0.06	<0.06	<0.06
Mercury	"	<0.001	0.008	<0.001
Selenium	"	0.007	0.004	0.003
Silver	"	<0.06	<0.06	<0.06

By B. Bruns For
Bruce S. Bruns
Mgr. of Lab Services

BSB/bb

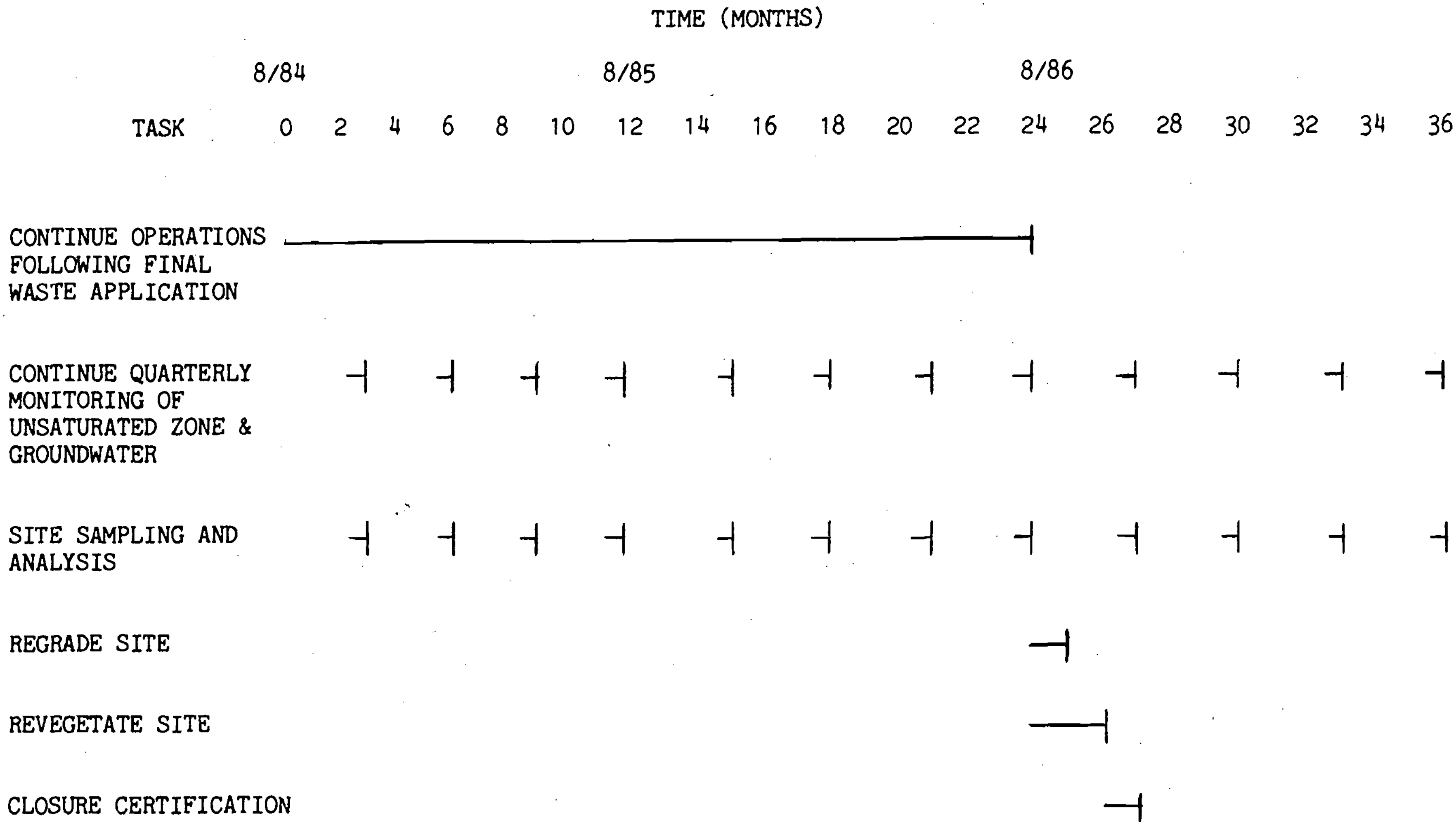


EXHIBIT 7
<u>CLOSURE TRACKING SCHEDULE FOR LAND TREATMENT UNIT</u>

EXHIBIT 8

BREAKDOWN OF CLOSURE COST ESTIMATE

Original Cost Estimate Summary (1981 dollars)

1. Pre-Closure Sampling $ 10,000
   a) personnel cost
      (2 technicians)(2 days) $\left(\frac{8\text{ hr}}{\text{day}}\right)\left(\frac{20\$}{\text{hr.}}\right)$ = $640

   b) chemical analysis
      $\left(\frac{4\text{ samples}}{\text{acre}}\right)$(8 acres)($200 test fee) = $6,400
      $7,040

2. Regrading $300,000
   a) backfilling with clean fill
      12,900 cubic yards = $258,000

   b) regrading of site
      $\left(\frac{\$5,000}{\text{acre}}\right)$ (8 acres) = $ 40,000
      $298,000

3. Revegetation and Drainage Control $ 40,000
   (includes 6-8" topsoil, seed, fertilizer and mulch)
   $\left(\frac{\$5,000}{\text{acre}}\right)$ (8 acres) = $40,000

4. Administration (~10%)
   (includes inspection and certification
   by Soil Scientist) $ 30,000

5. Contingency (20%) $ 70,000

TOTAL CLOSURE COST $450,000

Cost Estimate Adjustment (1985 dollars)

$450,000 x 1.09 x 1.06 x 1.042 x 1.038 = $565,000.

EXHIBIT 9

FINANCIAL ASSURANCE MECHANISM FOR CLOSURE

EXXON COMPANY, U.S.A.
POST OFFICE BOX 222 • LINDEN, NEW JERSEY 07036-0222

REFINING DEPARTMENT
BAYWAY REFINERY

July 19, 1985

Financial Assurance
NJP-062037031

Frank Coolick, Chief
Bureau of Hazardous Waste Engineering
Department of Environmental Protection
32 East Hanover Street
CN 028
Trenton, New Jersey 08625

Dear Mr. Coolick:

Attached is an amendment to the financial assurance for closure costs and post-closure costs for hazardous waste facilities at the Exxon Bayway Refinery in accordance with N.J.A.C. 7:26-9.1 et seq. Specifically, the amendment increases our Letter of Credit No. 10370/83B from First Fidelity Bank (formerly First National State Bank) to a total amount of $1,228,000. The increase recognizes 1985 escalated estimates for the cost of closure and post-closure care.

The original Letter of Credit and Trust Agreement with the bank were sent to you by letter dated June 8, 1984. All other terms and conditions remain unchanged.

Should you have any questions, please call me at (201) 474-7585.

Very truly yours,

W. L. Taetzsch
Environmental Coordinator

WLT/dho
Attachment

FIRST FIDELITY BANK
FIRST FIDELITY BANK, N.A., New Jersey
550 Broad Street, P.O. Box 15073
Newark, New Jersey 07192 U.S.A.
International Banking Department

Swift # FNSB US 33
Telex Numbers 475 4082, 178
Applicant's Copy 3

AMENDMENT TO DOCUMENTARY CREDIT

LC No: 10570/85 B

Date: MAY 23, 1985

Beneficiary:

NEW JERSEY STATE DEPARTMENT
OF ENVIRONMENTAL PROTECTION
32 HANOVER STREET
TRENTON, NJ 08625

Applicant:

EXXON COMPANY U.S.A.
A DIVISION OF EXXON CORPORATION
P.O. BOX 2180, SUITE 3754
HOUSTON, TEXAS 77001

Gentlemen:

The above mentioned credit is amended as follows:

AMOUNT OF CREDIT INCREASED BY $46,000.00 TO AN AGGREGATE TOTAL AMOUNT OF $1,226,000.00 REFLECTING THE FOLLOWING:

ADJUSTED CLOSURE AMOUNT	ADJUSTED POST CLOSURE AMOUNT
$802,000.00	$420,000.00

This amendment is to be considered as part of the above mentioned credit and must be attached thereto.

All other terms and conditions remain unchanged.

Instructions to the Advising Bank:
Please complete and forward to the beneficiary the attached original advice.

Very truly yours,

Authorized Signature

First National State

First National State Bank of New Jersey
550 Broad Street Newark NJ 07101 U.S.A

International Banking Department

IRREVOCABLE STANDBY LETTER
OF Credit No 10370/83 Page No ONE OF TWO Date AUGUST 29, 1983

NEW JERSEY STATE DEPARTMENT
OF ENVIRONMENTAL PROTECTION
32 HANOVER STREET
TRENTON, N.J. 08625

GENTLEMEN:

WE HEREBY ISSUE IN YOUR FAVOR THIS IRREVOCABLE STANDBY LETTER OF CREDIT FOR THE ACCOUNT OF:

EXXON COMPANY, U.S.A.
A DIVISION OF EXXON CORPORATION
P.O. BOX 2180, SUITE 3754
HOUSTON, TEXAS 77001
ATTN: CATHRYN RODD

TO THE EXTENT OF US$1,134,000.00 (ONE MILLION ONE HUNDRED THIRTY FOUR THOUSAND AND 00/100 U.S. DOLLARS)

THIS LETTER OF CREDIT IS RELATIVE TO THE FOLLOWING "SCHEDULE OF COVERAGE":

EPA FACILITY I.D. NO.	PLANT NAME AND ADDRESS	ADJUSTED CLOSURE AMOUNT	AND	ADJUSTED POST-CLOSURE AMOUNT
NJT 000029447	BAYWAY REFINERY LINDEN, NEW JERSEY	$741,000		$393,000

AVAILABLE BY YOUR DRAFTS DRAWN ON US AT SIGHT ACCOMPANIED BY:
YOUR SIGNED STATEMENT SHOWING NAME AND TITLE OF SIGNER READING AS FOLLOWS:

> "WE CERTIFY THAT THE AMOUNT OF THE DRAFT IS PAYABLE PURSUANT TO AND IN ACCORDANCE WITH REGULATIONS ISSUED UNDER AUTHORITY OF THE NEW JERSEY SOLID WASTE MANAGEMENT ACT, N.J.S.A. 13: 1E-1, et seq. AND SUCH OTHER STATUTES AS MAY BE CITED PROVIDING THE DEPARTMENT AUTHORITY TO ACT IN THIS AREA".

THIS LETTER OF CREDIT IS EFFECTIVE AS OF AUGUST 29, 1983 AND SHALL EXPIRE ON AUGUST 29, 1984 BUT SUCH EXPIRATION DATE SHALL BE AUTOMATICALLY EXTENDED FOR A PERIOD OF ONE (1) YEAR ON AUGUST 29, 1984 AND ON EACH SUCCESSIVE EXPIRATION DATE UNLESS, AT LEAST NINETY (90) DAYS BEFORE THE CURRENT EXPIRATION DATE,

"CONTINUED ON PAGE TWO WHICH FORMS
AN INTEGRAL PART OF THIS CREDIT"

Very truly yours

AUTHORIZED SIGNATURE

P

First National State

First National State Bank of New Jersey
550 Broad Street, Newark, NJ 07101 U.S.A.

International Banking Department

"ATTACHED TO AND FORMING AN INTEGRAL PART OF THIS CREDIT"

Credit No 10370/83 Page No TWO OF TWO Date AUGUST 29, 1983

WE NOTIFY BOTH YOU AND EXXON COMPANY, U.S.A. HOUSTON BY CERTIFIED MAIL, RETURN RECEIPTS REQUESTED, THAT WE HAVE DECIDED NOT TO EXTEND THIS LETTER OF CREDIT BEYOND THE CURRENT EXPIRATION DATE. IN THE EVENT YOU ARE SO NOTIFIED, ANY UNUSED PORTION OF THIS CREDIT SHALL BE AVAILABLE FOR NINETY (90) DAYS AFTER THE DATE OF RECEIPT BY BOTH YOU AND EXXON COMPANY, U.S.A. HOUSTON, AS SHOWN ON THE SIGNED RETURN RECEIPTS, IN ACCORDANCE WITH THE TERMS OF THIS LETTER OF CREDIT.

IN THE EVENT THIS LETTER OF CREDIT IS DRAWN ON, WE SHALL DEPOSIT THE AMOUNT OF YOUR DRAFT DIRECTLY INTO THE STANDBY TRUST FUND MAINTAINED BY FIRST NATIONAL STATE BANK OF NEW JERSEY AS TRUSTEE, ESTABLISHED BY EXXON COMPANY, U.S.A.

ORIGINAL LETTER OF CREDIT MUST BE PRESENTED WITH DOCUMENTS.

DRAFTS MUST BE MARKED AS DRAWN UNDER LETTER OF CREDIT NO. 10370/83 OF THE FIRST NATIONAL STATE BANK OF NEW JERSEY.

EXCEPT AS OTHERWISE EXPRESSLY STATED HEREIN, THIS CREDIT IS SUBJECT TO THE UNIFORM CUSTOMS AND PRACTICES FOR DOCUMENTARY CREDITS (1974 REVISION) INTERNATIONAL CHAMBER OF COMMERCE PUBLICATION NO. 290.

WE ENGAGE WITH YOU THAT ALL DRAFTS DRAWN UNDER AND IN COMPLIANCE WITH THE TERMS OF THIS CREDIT WILL BE DULY HONORED UPON PRESENTATION OF DOCUMENTS, AS SPECIFIED ABOVE, TO US AT 550 BROAD STREET, NEWARK, NEW JERSEY, ATTN: INTERNATIONAL DEPT. NOT LATER THAN THE CLOSE OF BUSINESS ON THE AFOREMENTIONED EXPIRY DATE.

WE HEREBY CERTIFY THAT THE WORDING OF THIS LETTER OF CREDIT IS SIMILAR TO THE WORDING REQUIRED PURSUANT TO N.J.A.C. 7:26-9.10 et seq, AS SUCH REGULATIONS WERE CONSTITUTED ON THE DATE SHOWN ABOVE.

Very truly yours

AUTHORIZED SIGNATURE

TRUST AGREEMENT

Trust Agreement, the "Agreement," entered into as of August 31, 1983 by and between Exxon Corporation, a New Jersey corporation, the "Grantor," and First National State Bank of New Jersey, a national bank, the "Trustee".

Whereas, the State of New Jersey Department of Environmental Protection, the "Department," has established certain regulations applicable to the Grantor, requiring that an owner or operator of a hazardous waste management facility shall provide assurance that funds will be available when needed for closure and/or post-closure care of the facility,

Whereas, the Grantor has elected to provide all or part of such financial assurance for the facilities identified herein by means of a Letter of Credit and a standby trust fund,

Whereas the Grantor, acting through its duly authorized officers, has selected the Trustee to be the trustee of the standby trust fund under this agreement, and the Trustee is willing to act as trustee,

Now, Therefore, the Grantor and the Trustee agree as follows:

<u>Section 1.</u> <u>Definitions. As used in this Agreeement:</u>

(a) The term "Grantor" means the owner or operator who enters in to this Agreement and any successors or assigns of the Grantor.

(b) The term "Trustee" means the Trustee who enters into this Agreement and any successor Trustee.

<u>Section 2.</u> <u>Identification of Facilities and Cost Estimates.</u> This Agreement pertains to the facilities and cost estimates identified on attached Schedule A.

<u>Section 3.</u> <u>Establishment of Fund.</u> The Grantor and the Trustee hereby establish a standby trust fund, the "Fund," for the benefit of the Department. The Grantor and the Trustee intend that no third party shall have access to the Fund except as herein provided. The Fund is established initially as consisting of the property, which is acceptable to the Trustee, described in Schedule B attached hereto. Such property and any other property subsequently transferred to the Trustee is referred to as the Fund, together with all earnings and profits thereon, less any payments or distributions made by the Trustee pursuant to this agreement. The Fund shall be held by the Trustee, IN TRUST, as hereinafter provided. The Trustee shall

not be responsible nor shall it undertake any responsibility for the amount or adequacy of, nor any duty to collect from the Grantor, any payments necessary to discharge any liabilities of the Grantor established by the Department.

Section 4. Payment for Closure and Post-Closure Care. The Trustee shall make such payments from the Fund as the Department shall direct, in writing, to provide for payment of the costs of closure and/or post-closure care of the facilities covered by this Agreement. The Trustee shall reimburse the Grantor or other persons as specified by the Department from the Fund for closure and post-closure expenditures in such amounts as the Department shall direct in writing. In addition, the Trustee shall refund to the Grantor such amounts as the Department specifies in writing. Upon refund, such funds shall no longer constitute part of the Fund as defined herein.

Section 5. Payments Comprising the Fund. Payments made to the Trustee for the Fund shall consist of cash or securities acceptable to the Trustee.

Section 6. Trustee Management. The Trustee shall invest and reinvest the principal and income of the Fund and keep the Fund invested as a single fund, without distinction between principal and income, in accordance with general investment policies and guidelines which the Grantor may communicate in writing to the Trustee from time to time subject, however, to the provisions of this Section. In investing, reinvesting, exchanging, selling, and managing the Fund, the Trustee shall discharge his duties with respect to the trust fund solely in the interest of the beneficiary and with the care, skill, prudence, and diligence under the circumstances then prevailing which persons of prudence, acting in a like capacity and familiar with such matters, would use in the conduct of an enterprise of a like character and with like aims; except that:

(i) Securities or other obligations of the Grantor, or any other owner or operator of the facilities, or any of their affiliates as defined in the Investment Company Act of 1940, as amended, 15 U.S.C. 80a-2.(a), shall not be acquired or held, unless they are securities or other obligations of the Federal or a State government;

(ii) The Trustee is authorized to invest the Fund in time or demand deposits of the Trustee, to the extent insured by an agency of the Federal or State government; and

(iii) The Trustee is authorized to hold cash awaiting investment or distribution uninvested for a resonable time and without liability for the payment of interest thereon.

Section 7. Commingling and Investment. The Trustee is expressly authorized in its discretion:

(a) To transfer from time to time any or all of the assets of the Fund to any common, commingled, or collective trust fund created by the Trustee in which the Fund is eligible to participate, subject to all of the provisions thereof, to be commingled with the assets of other trusts participating therein; and

(b) To purchase shares in any investment company registered under the Investment Company Act of 1940, 15 U.S.C. 80a-1 et seq., including one which may be created, managed, underwritten, or to which investment advice is rendered or the shares of which are sold by the Trustee. The Trustee may vote such shares in its discretion.

Section 8. Express Powers of Trustee. Without in any way limiting the powers and discretions conferred upon the Trustee by the other provisions of this agreement or by law, the Trustee is expressly authorized and empowered:

(a) To sell, exchange, convey, transfer or otherwise dispose of any property held by it, by public or private sale. No person dealing with the Trustee shall be bound to see to the application of the purchase money or to inquire into the validity or expediency of any such sale or other disposition;

(b) To make, execute, acknowledge, and deliver any and all documents of transfer and conveyance and any and all other instruments that may be necessary or appropriate to carry out the powers herein granted;

(c) To register any securities held in the Fund in its own name or in the name of a nominee and to hold any security in bearer form or in book entry, or to combine certificates representing such securities with certificates of the same issue held by the Trustee in other fiduciary capacities, or to deposit or arrange for the deposit of such securities in a qualified central depositary even though, when so deposited, such securities may be merged and held in bulk in the name of the nominee of such depositary with other securities deposited therein by another person, or to deposit or arrange for the deposit of any securities issued by the United States Government, or any agency or instrumentality thereof, with a Federal Reserve bank, but the books and records of the Trustee shall at all times show that all such securities are part of the Fund;

(d) To deposit any cash in the Fund in interest-bearing accounts maintained or savings certificates issued by the Trustee, in its separate corporate capacity, or in any other banking institution affiliated with the Trustee, to the extent insured by an agency of the Federal or State government; and

(e) To compromise or otherwise adjust all claims in favor of or against the Fund.

Section 9. Taxes and Expenses. All taxes of any kind that may be assessed or levied against or in respect of the Fund and all brokerage commissions incurred by the Fund shall be paid from the Fund. All other expenses incurred by the Trustee in connection with the administration of the Trust, including fees for legal services rendered to the Trustee, the compensation of the Trustee to the extent not paid directly by the Grantor, and all other proper charges and disbursements of the Trustee shall be paid from the Fund.

Section 10. Annual Valuation. The Trustee shall annually, at least 30 days prior to the anniversary date of establishment of the Fund, furnish to the Grantor and to the Department a statement confirming the value of the Trust. Any securities in the Fund shall be valued at market value as of no more than 60 days prior to the anniversary date of establishment of the Fund. The failure of the Grantor to object in writing to the Trustee within 90 days after the statement has been furnished to the Grantor and the Department shall constitute a conclusively binding assent by the Grantor, barring the Grantor from asserting any claim or liability against the Trustee with respect to matters disclosed in the statement.

<u>Section 11</u>. <u>Advice of Counsel</u>. The Trustee may from time to time consult with counsel, who may be counsel to the Grantor, with respect to any question arising as to the construction of this Agreement or any action to be taken hereunder. The Trustee shall be fully protected, to the extent permitted by law, in acting upon the advice of counsel.

<u>Section 12</u>. <u>Trustee Compensation</u>. The Trustee shall be entitled to reasonable compensation for its services as agreed upon in writing from time to time with the Grantor.

<u>Section 13</u>. <u>Successor Trustee</u>. The Trustee may resign or the Grantor may replace the Trustee, but such resignation or replacement shall not be effective until the Grantor has appointed a successor trustee and this successor accepts the appointment. The successor trustee shall have the same powers and duties as those conferred upon the Trustee hereunder. Upon the successor trustee's acceptance of the appointment, the Trustee shall assign, transfer, and pay over to the successor trustee the funds and properties then constituting the Fund. If for any reason the Grantor cannot or does not act in the event of the resignation of the Trustee, the Trustee may apply to a court of competent jurisdiction for the appointment of a successor trustee or for instructions. The successor trustee shall specify the date on which it assumes administration of the trust in a writing sent to the grantor, the Department, and the present Trustee by certified mail 10 days before such change becomes effective. Any expenses incurred by the Trustee as a result of any of the acts contemplated by this Section shall be paid as provided in Section 9.

<u>Section 14</u>. <u>Instruction to the Trustee</u>. All orders, requests, and instructions by the Grantor to the Trustee shall be in writing, signed by such persons as are designated in the attached Exhibit A or such other designees as the Grantor may designate by amendment to Exhibit A. The Trustee shall be fully protected in acting without inquiry in accordance with the Grantor's orders, requests, and instructions. All orders, requests, and instructions by the Department to the Trustee shall be in writing, signed by the Commissioner of the Department or his or her designee, and the Trustee shall act and shall be fully protected in acting in accordance with such orders, requests, and instructions. The Trustee shall have the right to assume, in the absence of written notice to the contrary, that no event constituting a change or a termination of the authority of any person to act on behalf of the Grantor or

the Department hereunder has occurred. The Trustee shall have no duty to act in the absence of such orders, requests, and instructions from the Grantor and/or the Department, except as provided for herein.

Section 15. Amendment of Agreement. This Agreement may be amended by an instrument in writing executed by the Grantor, the Trustee, and the Department, or by the Trustee and the Department if the Grantor ceases to exist.

Section 16. Irrevocability and Termination. Subject to the right of the parties to amend this Agreement as provided in Section 15, this Trust shall be irrevocable and shall continue until terminated at the written agreement of the Grantor, the Trustee, and the Department, or by the Trustee and the Department, if the Grantor ceases to exist. Upon termination of the Trust, all remaining trust property, less final trust administration expenses, shall be delivered to the Grantor.

Section 17. Immunity and Indemnification. The Trustee shall not incur personal liability of any nature in connection with any act or omission, made in good faith in the administration of this Trust, or in carrying out any directions by the Grantor or the Department issued in accordance with this Agreement. The Trustee shall be indemnified and saved harmless by the Grantor or from the Fund, or both, from and against any personal liability to which the Trustee may be subjected by reason of any act or conduct in its official capacity, including all expenses reasonably incurred in its defense in the event the Grantor fails to provide such defense.

Section 18. Choice of Law. This Agreement shall be administered, construed, and enforced according to the laws of the State of New Jersey.

Section 19. Interpretation. As used in this Agreement, words in the singular include the plural and words in the plural include the singular. The descriptive headings for each Section of this Agreement shall not affect the interpretation or the legal efficacy of this Agreement.

In Witness Whereof the parties have caused this Agreement to be executed by their respective officers duly authorized and their corporate seals to be hereunto affixed and attested as of the date first above written: The parties below certify that the wording of this Agreement is identical in all material respects to the wording specified in 40 CFR 264.151(a)(1) as such regulations were constituted on the date first above written.

(Seal)

Exxon Company, U.S.A. (a division of Exxon Corporation)

Attest: A. L. Rosa

Title: Assistant Secretary

By: T. H. Crichlow, Jr.
Assistant Treasurer

(Seal)

OMB APPROVED

Attest:

Title:

By:

CERTIFICATION OF ACKNOWLEDGEMENT

State of Texas
County of Harris

On this 23rd day of August before me personally came T. H. Crichlow, Jr. to me known, who being by me duly sworn, did depose and say that he resides at 607 Electra, Houston that he is an assistant treasurer of Exxon Corporation, the corporation described in and which executed the above instrument; that he knows the seal of said corporation; that the seal affixed to such instrument is such corporate seal; that it was so affixed by order of the Board of Directors of said corporation; and that he signed his name thereto by like order.

Eloise C. Wilson

ELOISE C. WILSON
Notary Public in and for Harris County, Texas
My Commission Expires May 31, 19[illegible]

State of New Jersey
County of ESSEX

On this 3rd day of AUGUST, 1983 before me personally came MICHAEL B. WATSON, to me known, who being by me duly sworn, did depose and say that ~~she~~/he resides at NEWARK NJ, that he is VICE PRESIDENT of First National State Bank of New Jersey, the corporation described in and which executed the above instrument; that he knows the seal of said corporation; that the seal affixed to such instrument is such corporate seal; that it was so affixed by order of the Board of Directors of said corporation; and that he signed his name thereto by like order.

Thomas Berlinski

THOMAS J. BERLINSKI
A NOTARY PUBLIC OF NEW JERSEY
My Commission Expires Sept. 25, 1985

SCHEDULE A TO TRUST AGREEMENT DATED AS OF BY AND BETWEEN EXXON COMPANY, U.S.A. (a division of Exxon Corporation) AS GRANTOR, AND FIRST NATIONAL STATE BANK OF NEW JERSEY, AS TRUSTEE

With reference to Section 2, Identification of Facility and Costs Estimates, the facilities to which this Agreement pertains are:

EPA ID#	Name & Address	Current Cost Estimates Closure	Post-Closure
NJT000029447	Bayway Refinery Exxon Company, U.S.A. (a division of Exxon Corporation) 1400 Park Avenue P. O. Box 222 Linden, N. J. 07036 (W. L. Taetzsch - Environ. Coor.)	$741,000	$393,000

SCHEDULE B TO TRUST AGREEMENT DATED AS OF
BY AND BETWEEN EXXON COMPANY, U.S.A.
(a division of Exxon Corporation) AS GRANTOR,
AND FIRST NATIONAL STATE BANK OF NEW JERSEY, AS TRUSTEE

With reference to Section 3 of the subject Trust Agreement, the Fund is established initially with property consisting of amounts which may be drawn under First National State Bank of New Jersey Standby Letter of Credit No. 10370/83, dated August 29, 1983, issued in favor of the New Jersey State Department of Environmental Protection.

EXHIBIT A TO TRUST AGREEMENT DATED AS OF
BY AND BETWEEN EXXON COMPANY, U.S.A.
(a division of Exxon Corporation) AS GRANTOR,
AND FIRST NATIONAL STATE BANK OF NEW JERSEY, AS TRUSTEE

With reference to Section 14 of the subject Trust Agreement, all orders, requests, and instructions by the Grantor to the Trustee shall be signed by one of the following persons:

Name	Title	Specimen Signature
S. B. L. Penrose	Assistant Treasurer	
T. H. Crichlow, Jr.	Assistant Treasurer	

EXHIBIT 10

COMPREHENSIVE LIABILITY INSURANCE POLICY

EXXON COMPANY, U.S.A.
POST OFFICE BOX 222 • LINDEN, NEW JERSEY 07036

REFINING DEPARTMENT
BAYWAY REFINERY

May 16, 1985

Frank Coolick, Chief
Bureau of Hazardous Waste Engineering
Department of Environmental Protection
32 East Hanover Street
CN 028
Trenton, New Jersey 08625

RE: Liability Coverage
NJP-062037031

Dear Mr. Coolick:

The enclosed letter to you, dated April 24, 1985 and signed by the Treasurer of Exxon Company, U.S.A., is submitted to provide liability coverage for the hazardous waste facilities at the Bayway Refinery in accordance with N.J.A.C. 7:26-9.,13. As noted in the letter, Exxon has chosen the financial test method for its liability coverage.

This coverage replaces the Liability Insurance Policy No.: L-132-7770-27 issued by Fireman's Fund in the amount of $8,000,000 which was sent to you on October 25, 1983.

Should you have any questions, please call me at (201) 474-7585

Very truly yours,

W. L. Taetzsch
Environmental Coordinator

WLT/vob

EXXON COMPANY, U.S.A.
... BOX 2180 · HOUSTON, TEXAS 77001

CAROL CLARK TATKON
TREASURER

April 24, 1985

Mr. Frank Koolick, Chief
Bureau of Hazardous Waste Engineering
Department of Environment Protection
32 East Hanover Street
Trenton, New Jersey 08625

Dear Mr. Koolick:

I am the chief financial officer of Exxon Company, U.S.A. (a division of Exxon Corporation) located at 800 Bell Street, Houston, Texas 77001. This letter is in support of the use of the financial test to demonstrate financial responsibility for liability coverage and closure and post-closure care as specified in Subpart H of 40 CFR Parts 264 and 265.

The owner or operator identified above is the owner or operator of the following facilities for which liability coverage is being demonstrated through the financial test specified in Subpart H of 40 CFR Parts 264 and 265: all facilities listed in paragraph (3) below.

1. The owner or operator identified above owns or operates the following facilities for which financial assurance for closure or post-closure care is demonstrated through the financial test specified in Subpart H of 40 CFR Parts 264 and 265. The current closure and/or post-closure cost estimates covered by the test are shown for each facility: none.

2. The owner or operator identified above guarantees, through the corporate guarantee specified in Subpart H of 40 CFR Parts 264 and 265, the closure and post-closure care of the following facilities owned or operated by its subsidiaries. The current cost estimates for the closure or post-closure care so guaranteed are shown for each facility: none.

3. In States where EPA is not administering the financial requirements of Subpart H of 40 CFR Parts 264 and 265, this owner or operator is demonstrating financial assurance for the closure or post-closure care of the following facilities through the use of a test equivalent or substantially equivalent to the financial test specified in Subpart H of 40 CFR Parts 264 and 265. The current closure and/or post-closure cost estimates covered by such a test are shown for each facility:

   a. Facilities at Exxon Company, U.S.A.'s Baytown, Texas Refinery

      - Exxon Company, U.S.A., Baytown Refinery
        P. O. Box 3950
        Baytown, Texas 77520
        (J. B. Graham - Supervisor Environmental Section)

- EPA Identification Number: TXD000782698

- Closure cost estimate: $4,941,400

- Post-closure cost estimate: $2,300,000

b. Facilities at Exxon Company, U.S.A.'s Baton Rouge, Louisiana Refinery

- Exxon Company, U.S.A., Baton Rouge Refinery
  P. O. Box 551
  Baton Rouge, Louisiana 70821
  (L. Kronenberger - Environmental Coordinator)

- EPA Identification Number: LAD062662887

- Closure cost estimate: $2,922,220

- Post-closure cost estimate: $1,656,600

c. Facilities at Exxon Company, U.S.A.'s Billings, Montana Refinery

- Exxon Company, U.S.A., Billings Refinery
  P. O. Box 1163
  Billings, Montana 59103
  (T. N. Schug - Environmental Coordinator)

- EPA Identification Number: MTD010380574

- Closure cost estimate: $779,900

- Post-closure cost estimate: $535,400

4. The owner or operator identified above owns or operates the following hazardous waste management facilities for which financial assurance for closure or, if a disposal facility, post-closure care, is not demonstrated either to EPA or a State through the financial test or any other financial assurance mechanism specified in Subpart H of 40 CFR Parts 264 and 265 or equivalent or substantially equivalent State mechanisms. The current closure and/or post-closure cost estimates not covered by such financial assurance are shown for each facility: none.

This owner or operator is required to file a Form 10K with the Securities and Exchange Commission (SEC) for the latest fiscal year.

The fiscal year of this owner or operator ends on December 31. The figures for the following items marked with an asterisk are derived from the owner's or operator's independently audited, year-end financial statements for the latest completed fiscal year, ended December 31, 1984.

1.	Sum of current closure and post-closure cost estimates (total of all cost estimates listed above)	$ 13,135,620	
2.	Amount of annual aggregate liability coverage to be demonstrated	$ 8,000,000	
3.	Sum of lines 1 and 2	$ 21,135,620	
4.	Current bond rating of most recent issuance and name of rating service	AAA Standard & Poor's	
5.	Date of issuance of bond	July 11, 1968	
6.	Date of maturity of bond	July 15, 1998	
*7.	Tangible net worth (if any portion of the closure or post-closure cost estimates is included in "total liabilities" on your financial statements you may add that portion to this line)	$28,526,000,000	
*8.	Total assets in the U.S. (required only if less than 90% of assets are located in the U.S.)	$24,921,000,000	
		YES	NO
9.	Is line 7 at least $10 million?	X	
10.	Is line 7 at least 6 times line 3?	X	
11.	Are at least 90% of assets located in the U.S.? If not, complete line 12.		X
12.	Is line 8 at least 6 times line 3?	X	

I hereby certify that the wording of this letter is identical to the wording specified in 40 CFR 264.151(g) as such regulations were constituted on the date shown immediately below.

April 24, 1985

C C Tatkon

C. C. Tatkon
Treasurer, Exxon Company, U.S.A.
(a division of Exxon Corporation)

CRITICAL INSTREAM WASTE CONCENTRATION
FOR THE
WASTEWATER TREATMENT PLANT DISCHARGE
AT THE BAYWAY REFINERY

PREPARED FOR:

BAYWAY REFINING COMPANY
LINDEN, NEW JERSEY

PREPARED BY:

IT CORPORATION
165 FIELDCREST AVENUE
EDISON, NEW JERSEY

JULY, 1994

1.0 Introduction

The Bayway refinery is located along the Arthur Kill in Linden, New Jersey. Figure 1 shows the location of this facility. The Arthur Kill is one component of the complex of waterways comprising the New York Harbor estuarine system. The refinery pumps about 130-170 MGD of brackish water from the Arthur Kill to be used for once-through non-contact cooling for various components of this facility. The cooling water is returned to the Arthur Kill via Morses Creek. This creek consists of an upper portion above Dam No. 2 which is unaffected by the refinery operations, and a lower portion between Dam No. 2 and the confluence of the creek with the Arthur Kill. The location of the lower portion of Morses Creek is shown in Figure 2. Between Dam No. 2 and Dam No. 1, cooling water is discharged into Morses Creek at three locations. These are shown in Figure 2. The three discharges are referred to as D2, Polyditch and Railroad Avenue Ditch. The D2 discharge is just below Dam No. 2, as shown in Figure 2. The nominal discharge rate through D2 is 35 MGD. Polyditch, with a nominal flow of 10 MGD, and Railroad Avenue Ditch, with a nominal flow of 125 MGD are over 4,000 feet downstream of Dam No. 2. Thus, the only continuous cooling water inflow over the reach from Dam 2 to Polyditch is the D2 discharge. During dry weather there is no overflow at Dam No. 2.

In addition to the cooling water flows, there is a discharge of effluent from The Wastewater Treatment Plant. This effluent with a nominal flow of about 7-8 MGD is discharged to Morses Creek in the immediate vicinity of the D2 discharge. The Wastewater Treatment Plant (WWTP) effluent discharge location is also shown in Figure 2. The D2 discharge is through a nearly rectangular channel with a mean width of 10 feet and a mean depth of about 3 feet. The Wastewater Treatment Plant discharge is through a rectangular channel with a width of 7 feet.

The purpose of this present study is to predict the dilution of the WWTP effluent in the immediate vicinity of its discharge into Morses Creek. In particular the nearfield dilution under critical conditions must be found. For present purposes critical conditions will be defined as the WWTP flow that will only be exceeded 10% of the time in combination with the lowest 10% D2 discharge. There are two critical instream concentrations; the criteria maximum concentration, CMC, and the criteria continuous concentration, CCC. The choice of where to apply these criteria is usually dependent on defining a zone of initial dilution wherein the initial momentum and buoyancy of the discharged effluent forces mixing with the receiving waters. In Morses Creek, however, the momentum of the WWTP effluent contributes to about 20% of the flow in the creek for a downstream distance of over 4000 feet. Consequently, it becomes possible to consider this entire reach of the creek as an initial mixing zone. Given this circumstance, the NJDEPE guidelines provide that the appropriate location for applying the CCC would be at a downstream distance of 100 m. The CMC would then be applied at 10% of this distance or 10 m from the discharge channel.

2.0 The Numerical Model

The numerical model used in this study was a two-dimensional, vertically averaged model which solves the equations for the conservation of mass, momentum and mass of a conservative constituent. The hydrodynamic portion of the model was used by Oey et. al (1985) and Thomas (1993) to model the flow in the Hudson Raritan estuary. Hires and Thomas (1993) modified the model to include the equation for the conservation of mass for a conservative scalar. The model solves the finite difference form of the following governing equations:

$$\frac{\partial n}{\partial t} + \frac{\partial}{\partial x}(\bar{u}D) + \frac{\partial}{\partial y}(\bar{v}D) = o$$

$$\frac{\partial}{\partial t}(\bar{u}^2 D) + \frac{\partial}{\partial y}(\overline{uv}D) - f\bar{v}D + gD\frac{\partial n}{\partial x} = t_x^w - C_D\bar{u}\left(\bar{u}^2+\bar{v}^2\right)^{1/2}$$

$$\frac{\partial}{\partial t}(\bar{v}D) + \frac{\partial}{\partial x}(\overline{uv}D) + \frac{\partial}{\partial y}(\bar{v}^2 D) + f\bar{u}D + gD\frac{\partial n}{\partial y} = t_y^w - C_D\,\bar{v}\left(\bar{u}^2+\bar{v}^2\right)^{1/2}$$

$$\frac{\partial}{\partial t}(\bar{C}D) + \frac{\partial}{\partial x}(\overline{uC}D) + \frac{\partial}{\partial y}(\overline{vC}D) = \frac{\partial}{\partial x}\left(A_x\frac{\partial \bar{C}D}{\partial x}\right) + \frac{\partial}{\partial y}\left(A_y\frac{\partial \bar{C}D}{\partial y}\right)$$

where:

- x,y = *lateral and longitudinal coordinates*
- f = *Coriolis parameters*
- n = *the surface elevation*
- $\bar{u},\bar{v}$ = *vertically averaged horizontal velocity components*
- $\bar{c}$ = *vertically averaged concentration*
- D = *local water depth*
- t_x^w, t_y^w = *surface wind stress*
- C_D = *bottom drag coefficient*
- A_x, A_y = *horizontal diffusivity*

The model domain consists of an idealized form of the upper 360 m of Morses creek. The average width of this portion of the creek is about 50 m while the average depth is about 0.7 m. This part of Morses creek is represented by a rectangular section with a width of 54 m and a longitudinal extent of 360 m. This model domain is covered by an 18 X 60 computational grid. In the cross stream direction, the grid spacing is $\Delta X = 3$ m while the longitudinal grid spacing is $\Delta Y = 6$ m. The first row of cells across the end of the model domain were treated as solid boundaries except for two cells which were used to introduce the D2 and WWTP discharges. At solid boundaries, the normal velocity must vanish as well as the normal derivative of the contaminant concentration. At the upstream end of the model, grid number 13 and number 16 (counting grids across from the left hand side) were left open. For these two grids, an inflow velocity corresponding to the WWTP (grid no. 13) and to the D2 discharge (grid no. 16) was specified. The lateral sides of the model domain were treated as solid boundaries. Finally, the downstream end of the model domain was open. At this boundary, the volume outflow and contaminant outflow were calculated by the model.

The model parameters which remained fixed for all cases were; $D = 0.7$ m at all grids throughout the domain, $C_D = 0.0025$, wind stress set to zero and $f = 1.0 \times 10^{-4} s^{-1}$. The lateral and longitudinal diffusivities; A_x, A_y, represent the parameters which could be adjusted to calibrate the model. For all model runs the time step was 0.25 sec. and the equations were integrated over 12 hours.

3.0 Field Studies

Two dye release experiments were conducted during the Fall of 1991 which may be used to calibrate and verify the nearfield mixing model for the WWTP effluent. Rhodamine WT dye was released continuously for 24 hours into the WWTP effluent on 26-27 September 1991. A similar 24-hour release into the D2 cooling water discharge channel was made on 1-2 October 1991.

The calibration and verification of the model predictions was accomplished through direct measurement of a tracer dye, Rhodamine WT, which was injected directly into the effluent streams. The dye was injected at a constant mass rate, M_D, into the effluent streams with a mass discharge rate, M. The concentration of the dye in the discharge pipe, C_O, is given by $C_O = M_D/M$. The dye was continuously injected using a precalibrated fluid metering pump.

Rhodamine WT dye was selected for use in this study because it has been shown to be a remarkably conservative substance in the natural water environment. The dye does not react chemically, it does not biologically degrade, and it does not adsorb to sediments. It was also chosen for use because of a well developed technology exists for measuring its concentration routinely to as low as 0.01 ppb. The determination of dye concentration was obtained by measuring the fluorescence and temperature of the water sample. When excited by light in the green portion of the visible spectrum, the dye molecules fluoresce in the orange portion of the spectrum. The intensity of fluorescence varies proportionally with the concentration of dye in the sample. The fluorescence also depends on temperature. Thus simultaneous measurements of fluorescence and temperature allow for the determination of dye concentration.

In these experiments, fluorescence was measured with a Turner Design Model 10 fluorometer and temperature with a YSI resistance-type thermometer. A continuous water sample was pumped through the fluorometer and then through a flow-cell containing the temperature probe. The meter readings from each instrument were recorded for each sampling location. The fluorometer was calibrated prior to the experiments and following the field work. Typical calibration curves for the fluorometer are shown in Figures 3 through 6 which are for the four most sensitive scales of the instrument. These calibration curves are obtained by pumping samples of known dye concentration through the instrument and correcting the observed fluorometer output for variations in temperature. Three features of the instrument calibrations are noteworthy: first, the instrument response is very linear with dye concentration; secondly, the full scale output on the most sensitive scale is obtained for a dye concentration of just 0.7 ppb, and finally repeated calibrations show remarkably little change in instrument sensitivity over intervals of several days.

The dye was metered into the effluent channels using a DC-powered constant-rate pump. The volume discharge rate of the pump at various settings was calibrated prior to use in these experiments. A check on the actual rate of dye discharged in each experiment was made by weighing the dye barrel before and following each experiment.

3.1 Wastewater Treatment Plant Effluent Dye Release

Dye was injected into the WWTP effluent from 1500 hours EDT on 26 September until 1630 hours on September 27. The point of injection was the Parshall Flume used to gauge the discharge rate of the plant effluent. The rate of injection was 43.4 lbs/day of 5% dye solution or 2.17 lbs. of dry dye per day. The dye was thoroughly mixed with the effluent by the time it had traveled from the flume to its point of discharge at Dam No. 2 in Morses Creek. The measured dye concentration in the effluent at its point of discharge of 1039 hours on September 27 was 20. 7 ppb. The calculated discharge rate for the effluent may be found from:

$$Q_E = \frac{M_D}{C_O \gamma_E}$$

where:

M_D	=	dye discharge rate in lbs/day
C_O	=	dye concentration in effluent
Q_E	=	effluent discharge rate in gallons/day
γ_E	=	effluent specific weight = 8.34 lbs/gallon for fresh water, and about 8.50 lbs/gallon for Arthur Kill water.

For the observed dye concentration of 20.7 ppb, the calculated discharge rate is 12.6 MGD, in close agreement with the flow rate indicated at that time by the Parshall flume.

The dye observations in Morses Creek were converted to dilutions of the WWTP effluent by using the relationship

$$S = C_O/C$$

where

S = the effluent dilution

C_O = the dye concentration in the effluent,

and

C = the observed dye concentration in Morses Creek.

The distribution of observed dilutions and temperature in Morses Creek in the nearfield is shown in Figure 7. The average dilution of about 4 in the farfield (100 feet or more from the point of discharge) in upper Morses creek is in accord with the assumption that the D2 discharge of 35 MGD is solely responsible for the dilution of the WWTP effluent in this portion of the creek. The Treatment Plant effluent appears to become well mixed vertically and laterally within 300 feet downstream of Dam No. 2.

3.2 Dye Release Into the D2 Discharge

The dye injection into the D2 discharge was started at 1615 hours on October 1, 1991 and stopped at 1400 hours on October 2, 1991. The discharge rate for the 5% dye solution was 43.4 lbs per day or 2.17 lbs of dry dye per day. The observed dye concentration in the mouth of the D2 channel at Dam No. 2 was 6.88 ppb. The calculated discharge through D2 was then 37.1 MGD in good agreement with the expected cooling water discharge through D2.

In the original report describing these dye release experiments, the dilution of the D2 discharge was reported. These values ranged from 1.2 to 1.6. For present purposes, these original dilutions of the D2 discharge must be converted to the corresponding values for WWTP effluent. the basic assumption underlying this conversion is that there were only two sources of water in upper Morses Creek i.e., the WWTP effluent and the D2 discharge. Thus a sample of creek water would consist of a mixture of water from these two sources. If X is the fraction of WWTP effluent in a sample then (1-X) will be the fraction of D2 discharge. If C_O is the concentration of dye in the D2 discharge then the concentration of dye in the sample, C, will be given by

$$(1-X)\, C_O = C$$

The calculated dilution of the D2 discharge is

$$S_D = C_O/C = 1/(1-X)$$

The required dilution for the WWTP effluent, S_W, is defined as

$$S_W = 1/X$$

Eliminating X between equations 1 and 2 yields the following relation between S_W and S_D

$$S_W = S_D/(S_D - 1)$$

The calculated WWTP effluent dilutions for the dye release through D2 are shown in Figure 8. The expected dilution for complete mixing of the two discharges would be 5.1 for the nominal flow of 35 MGD through D2 and the measured flow of 8.8 MGD for the WWTP effluent.

Model Results

Three modeling studies were conducted; the first to calibrate the model, the second for verification and the third for critical conditions. For the calibration study the model was run under the discharge conditions observed during the dye release experiment on September 27, 1991. A systematic series of model runs were made for differing values of A_x and A_y. Comparison of these results with the dye observations were made for each run. The result of this process was the selection of the following distribution of values for A_x and A_y:

> For all computational grids at downstream distance of 60 m and greater (10 or more grid spaces) the values for both A_x and A_y were held constant at 0.05 m^2/s. Also, for all lateral grids from number 1 to number 10, the values were also kept at 0.05 m^2/s. In the remaining grids, the diffusivity increased linearly to a value of 0.5 m^2/s at the upstream right hand corner of the model domain. This increased diffusivity serves to simulate in the model the mixing which must take place between the two discharges in their actual geometric relationship to each other (see Figures 7 or 8).

The simulation of conditions on September 27th, using the values for A_x and A_y described above, is present in Figure 9. This figure shows the distribution of WWTP effluent in terms of dilutions.

The dilution isopleths are shown at intervals of 0.25, showing lines of constant dilution. It should be noted that the lateral distance shown in the figure is 42 m, represented by 6 inches, while in the longitudinal direction, the upper 120 meters of the creek are shown, represented by 4.3 inches. Thus, the lateral distances are shown exaggerated by a factor of 4.

The dilution values in the first 25 m downstream of the dam vary from 2.0 to 3.25. On a transect approximately 25 m downstream of the dam, the values range from 2.75 to 3.25. These values are in good agreement with the observed dilutions for this day, shown in Figure 7. There is a slight underprediction of dilution in the vicinity of the bank opposite the discharges. This underprediction insures that the model will provide conservative dilution estimates.

Once the model was calibrated by comparison with the September 27, 1991 dye study, a verification study was conducted using the dye observations on October 2, 1991. For this study the WWTP effluent discharge rate was 8.8 MGD and the D2 discharge was 37 MGD. The model was run for the values of Ax and Ay established in the calibration study. The results of this verification study are presented in Figure 10.

The dilutions predicted by the model in the first 25 m downstream of the dam have values ranging from 2.1 to 4.75. This is in reasonable agreement with observations.

In the final modeling study, the model was run for the critical conditions. The highest 10th percentile waste water treatment plant flow was obtained by creating a cumulative distribution curve for measured weekly average flows from the interval 12/28/92 through 1/2/94. The lowest 10th percentile flows in D2 were obtained by using measured weekly average flows at Dam No. 1 for this same time interval. The percentage contribution of D2 discharge to the measured discharge at Dam No. 1 was obtained from the observations on October 2, 1991. The dye release through D2 on this date provided a measured discharge of 37 MGD while the measured average daily discharge at Dam No. 1 on this date was 135 MGD. The factor 37/135 was then applied to the lowest 10th percentile Dam No. 1 average weekly flow to obtain the lowest 10th percentile D2 flow. From these considerations the following critical conditions were obtained:

D2 discharge lowest 10th percentile = 32.1 MGD
WWTP discharge highest 10th percentile = 7.7 MGD

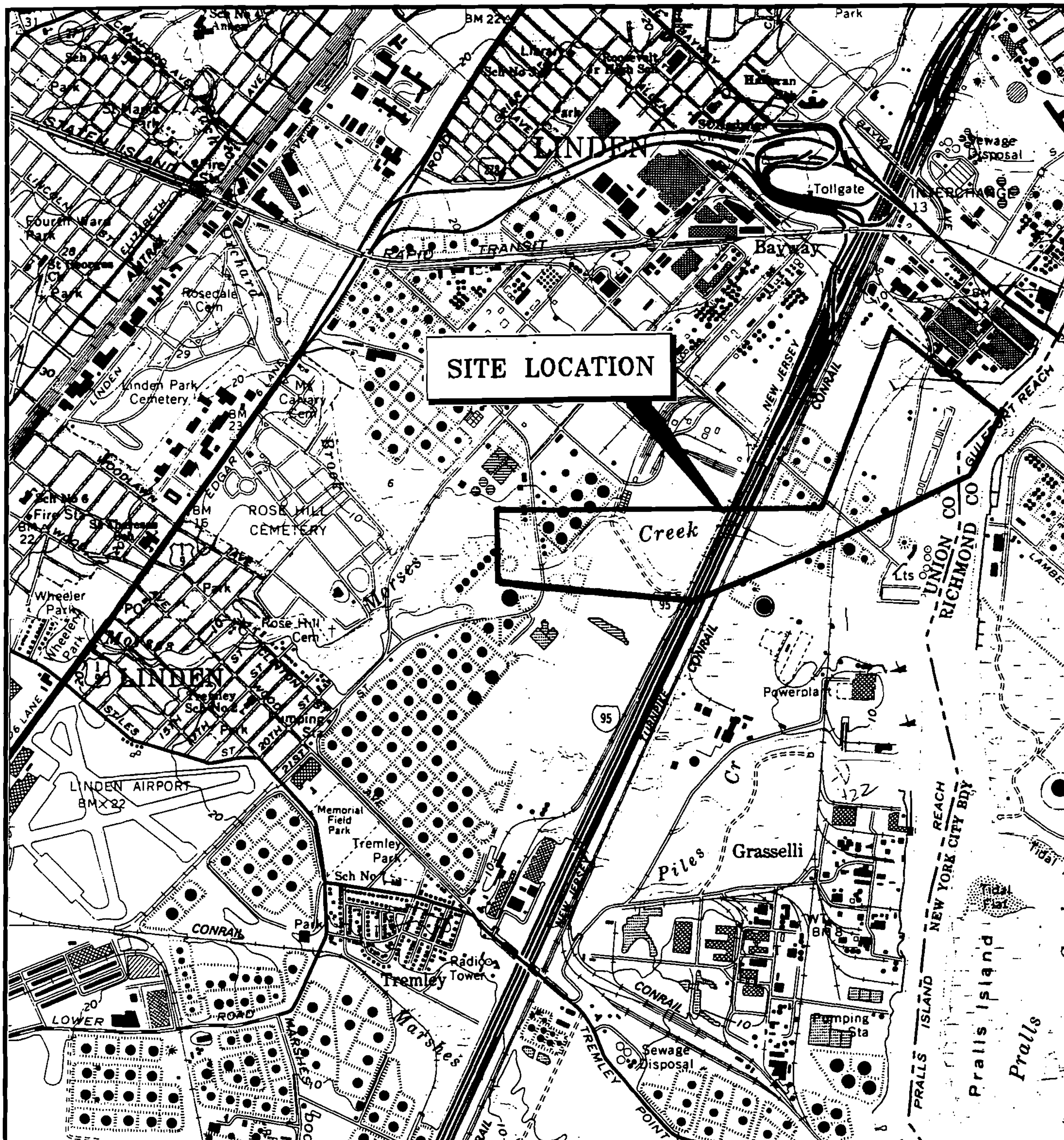
The result of this simulation was presented in Figure 11. The dilution values computed for this condition range from 3.5 to 6.5 in the first 120 meters downstream of the dam. The dilution values for CMC condition is calculated at 10 m downstream and CCC dilution values at 100 m downstream. These distances are shown by the dashed lines in Figure 11. The critical dilutions in Morses Creek are as follows:

For Criteria Maximum Concentration (CMC) = 3.1
For Criteria Continuous Concentration (CCC) = 5.0

Morses Creek, Critical Instream Waste Concentration Study, Weekly Average Flow Data

Week Ending	Dam #1 Flow, MG/D	WWTP Flow, MG/D
1/3/93	111.2	6.70
1/10/93	136.1	8.23
1/17/93	128.8	6.94
1/24/93	108.0	6.70
1/31/93	103.0	6.11
*2/7/93	101.0	5.61
*2/14/93	112.2	6.02
*2/21/93	100.1	5.32
*2/28/93	92.7	4.91
*3/7/93	119.6	5.76
*3/14/93	115.6	4.43
3/21/93	106.6	7.17
3/28/93	134.5	8.10
4/4/93	140.2	7.81
4/11/93	151.9	7.21
4/18/93	123.6	6.68
4/25/93	126.7	6.43
5/2/93	127.3	5.85
5/9/93	140.9	6.21
5/16/93	134.0	6.60
5/23/93	136.2	6.21
5/30/93	138.1	6.50
6/6/93	143.8	7.28
6/13/93	139.2	6.53
6/20/93	140.0	6.37
6/27/93	143.0	7.07
7/4/93	147.9	7.25
7/11/93	145.9	7.46
7/18/93	150.6	7.64
7/25/93	148.3	7.37
8/1/93	150.3	6.91
8/8/93	161.5	7.55
8/15/93	196.5	7.50
8/22/93	198.2	7.84
8/29/93	148.4	7.37
9/5/93	151.4	7.25
9/12/93	164.8	7.12
9/19/93	211.7	7.62
9/26/93	152.1	7.50
10/3/93	149.1	7.32
10/10/93	146.0	6.20
10/17/93	150.0	6.08
10/24/93	160.0	7.10
10/31/93	149.0	6.90
11/7/93	146.6	7.07
11/14/93	158.6	6.27
11/21/93	146.2	5.63
11/28/93	129.8	6.94
12/5/93	138.9	7.11
12/12/93	126.6	6.33
12/19/93	121.5	5.47
12/26/93	123.3	5.97
1/2/94	110.3	5.49

*Data not used due to turnaround.



SOURCE: USGS 7.5 MINUTE SERIES TOPOGRAPHIC MAP, ARTHUR KILL AND ELIZABETH, N.J. QUADRANGLES, 1966, PHOTOREVISED 1981.

1000 0 1000 2000

SCALE OF FEET

REV. NO.	DATE	DESCRIPTION OF REVISION	REV. BY	ENG	CHKD BY	APPVD BY

PROJECT MANAGER: M. NURRY DRAWN BY: E.W. DATE: 6/7/94

INTERNATIONAL TECHNOLOGY CORPORATION

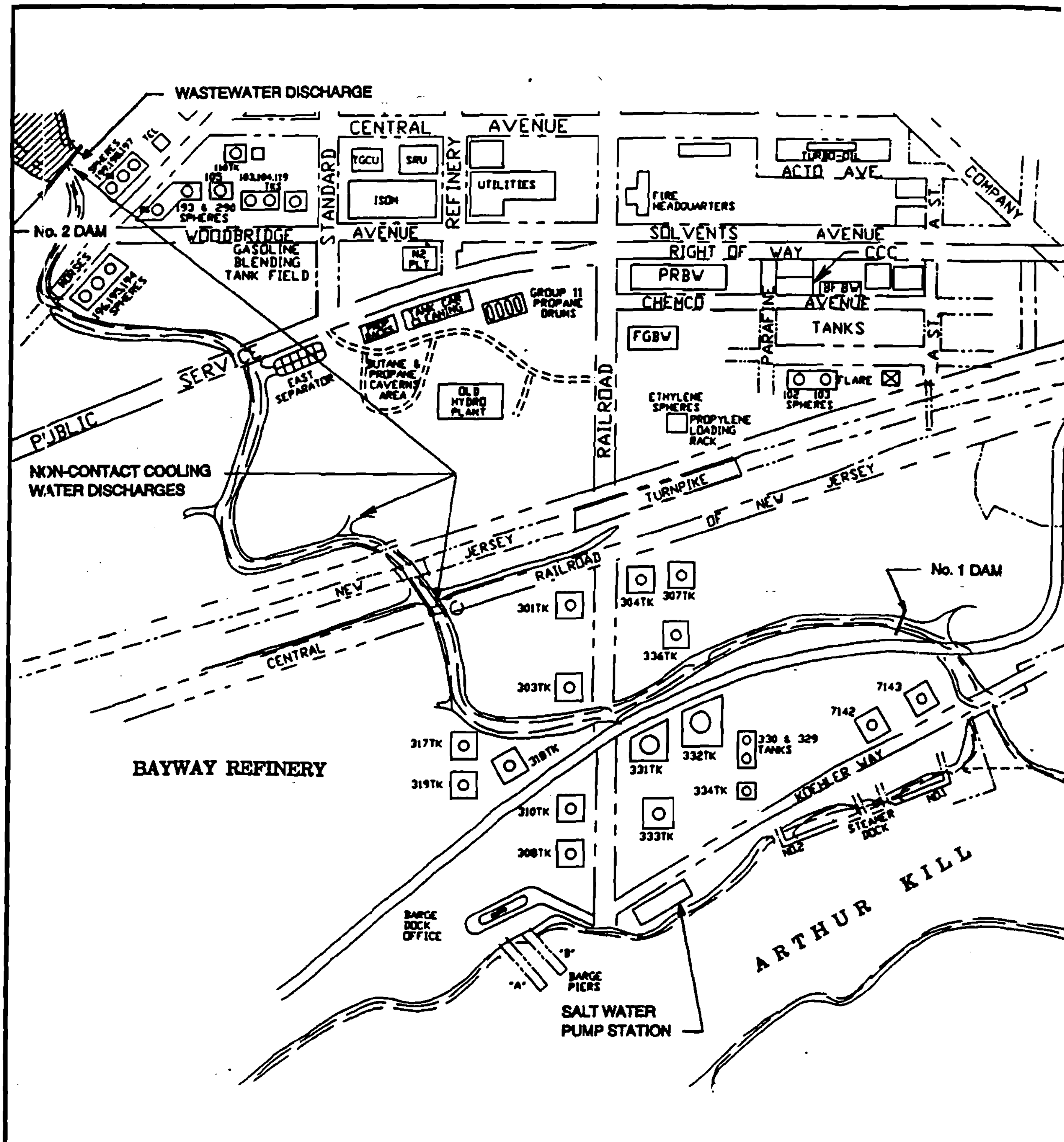
FIGURE 1
SITE LOCATION MAP
MORSES CREEK
LINDEN, NEW JERSEY

Prepared For:

BAYWAY REFINING COMPANY
LINDEN, NEW JERSEY
JUNE 1994

PROJECT NO.	FILE NO.	CHK'D / ENG. / APPVD.	DRAWING NUMBER	REV. NO.
542110	A1		542110–A1	

529624A1 03/18/93 9:39am J.R.D.



SOURCE:
EXXON COMPANY, USA

NOT TO SCALE

REV. NO.	DATE	DESCRIPTION OF REVISION	REV. BY	ENG	CHKD BY	APPVD BY

PROJECT MANAGER: M. MURRAY DRAWN BY: E.W. DATE: 6/7/94

IT INTERNATIONAL TECHNOLOGY CORPORATION

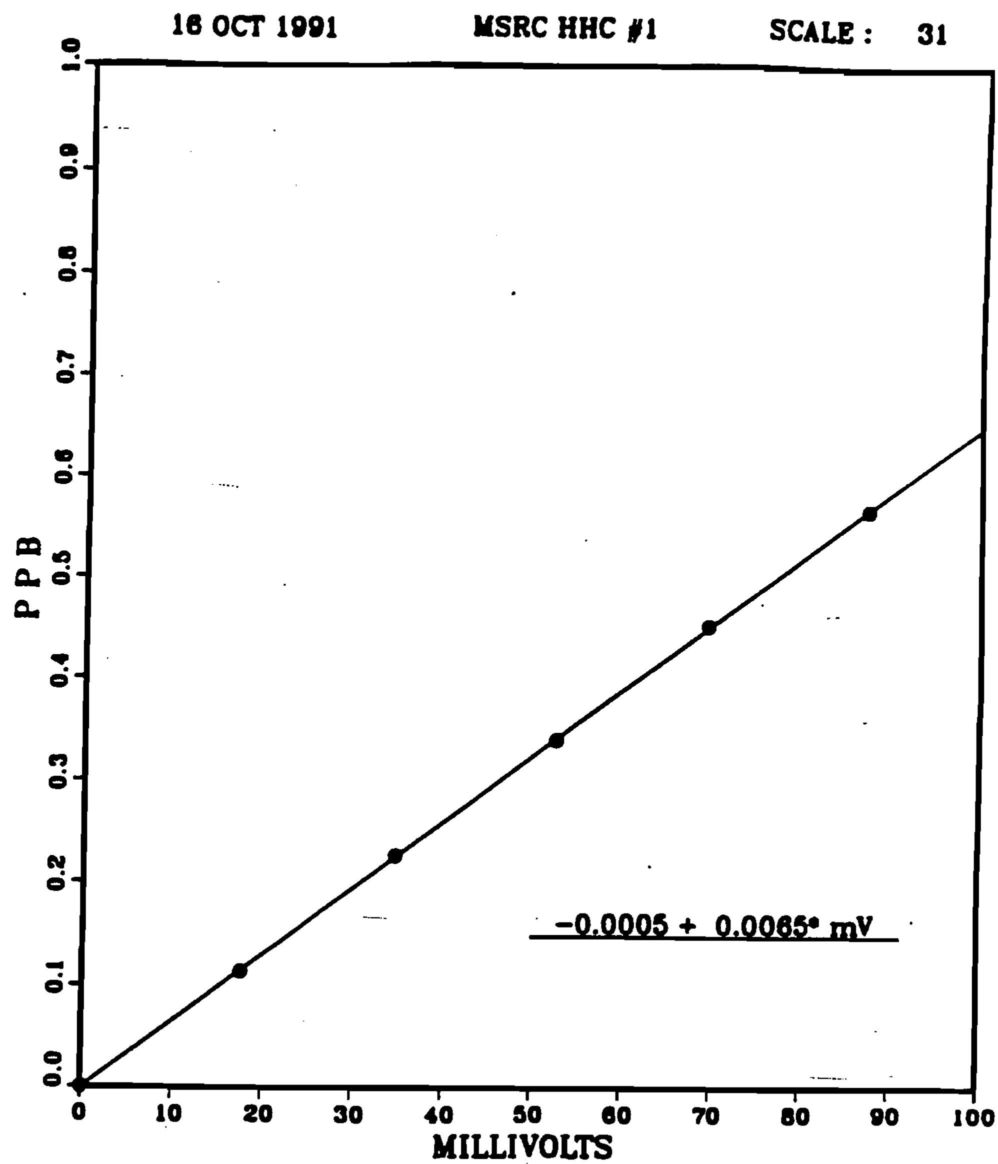
FIGURE 2
BAYWAY REFINERY
LINDEN, NEW JERSEY

Prepared For:

BAYWAY REFINING COMPANY
LINDEN, NEW JERSEY
JUNE 1994

PROJECT NO.	FILE NO.	CHK'D / ENG. / APPVD.	DRAWING NUMBER	REV. NO.
542110	A2		542110-A2	

542010A2 06/07/94 9:45am EDDY K. WU



REV. NO.	DATE	DESCRIPTION OF REVISION	REV. BY	ENG	CHKD BY	APPVD BY

PROJECT MANAGER: M. MURRAY DRAWN BY: E.W. DATE: 6/7/94

INTERNATIONAL TECHNOLOGY CORPORATION

FIGURE 3

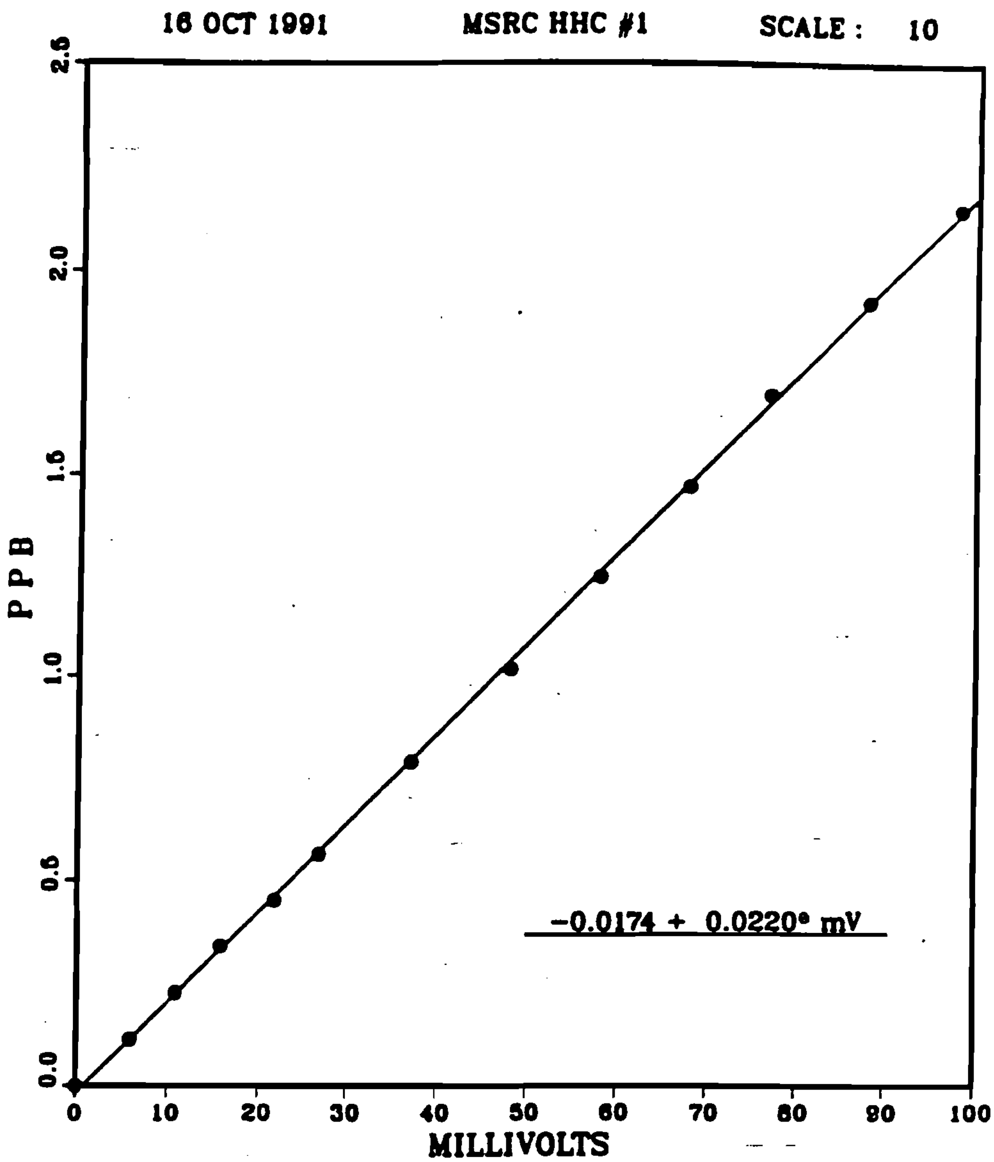
FLUOROMETER CALIBRATION

Prepared For:

BAYWAY REFINING COMPANY
LINDEN, NEW JERSEY
JUNE 1994

PROJECT NO.	FILE NO.	CHK'D / ENG. / APPVD.	DRAWING NUMBER	REV. NO.
542110	A3		542110−A3	

542010A3 06/07/94 0:41pm EDDY K. WU



REV. NO.	DATE	DESCRIPTION OF REVISION	REV. BY	DES	CHKD BY	APPVD BY

PROJECT MANAGER: N. MURRAY — DRAWN BY: E.W. — DATE: 6/7/94

IT INTERNATIONAL TECHNOLOGY CORPORATION

FIGURE 4

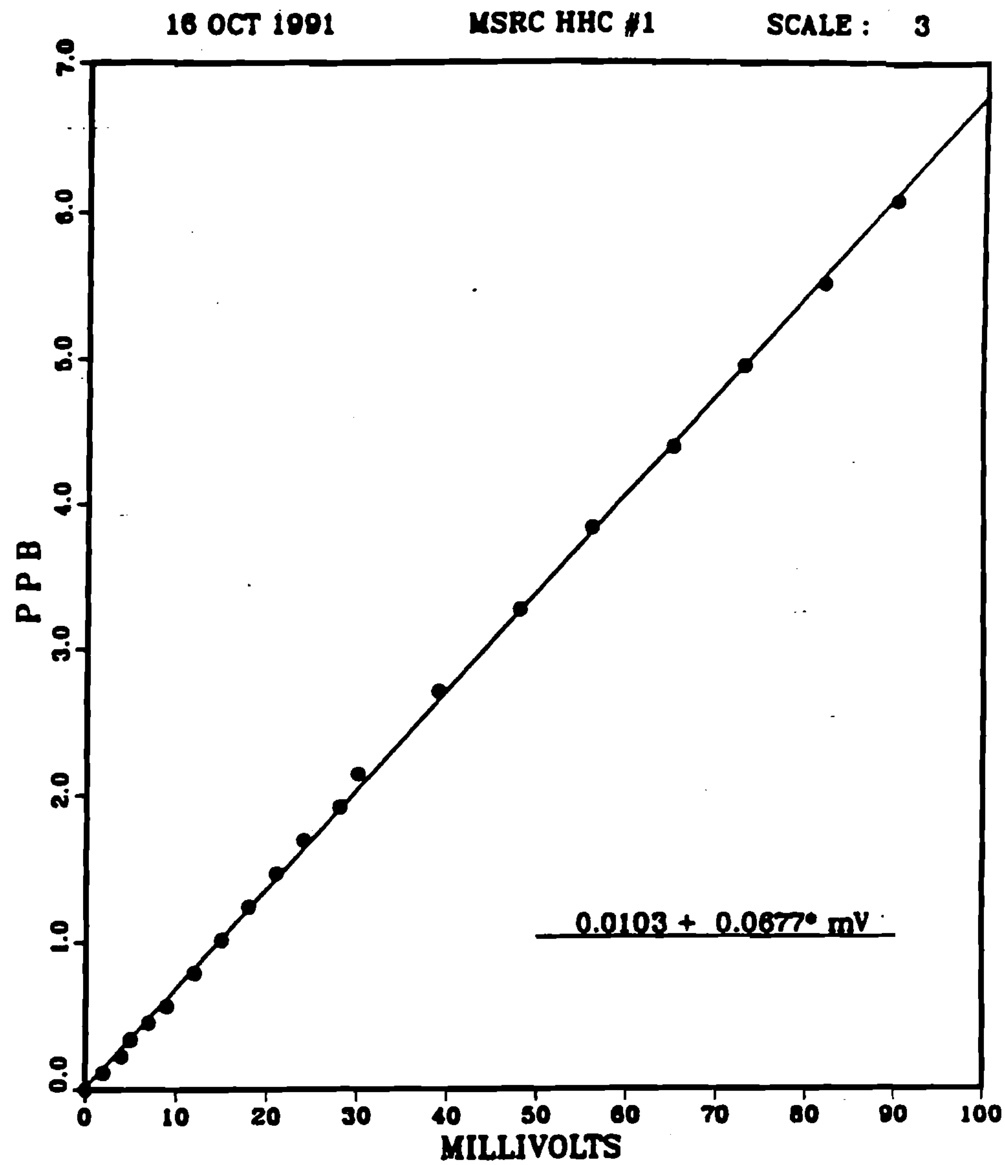
FLUOROMETER CALIBRATION

Prepared For:

BAYWAY REFINING COMPANY
LINDEN, NEW JERSEY
JUNE 1994

PROJECT NO.	FILE NO.	CHK'D / DES. / APPVD.	DRAWING NUMBER	REV. NO.
542110	A3		542110-A3	

542010A3 06/07/94 0:41pm EDDY K. WU



REV. NO.	DATE	DESCRIPTION OF REVISION	REV. BY	ENG	CHKD BY	APPVD BY

PROJECT MANAGER: M. MURRAY — DRAWN BY: E.W. — DATE: 6/7/94

INTERNATIONAL TECHNOLOGY CORPORATION

FIGURE 5

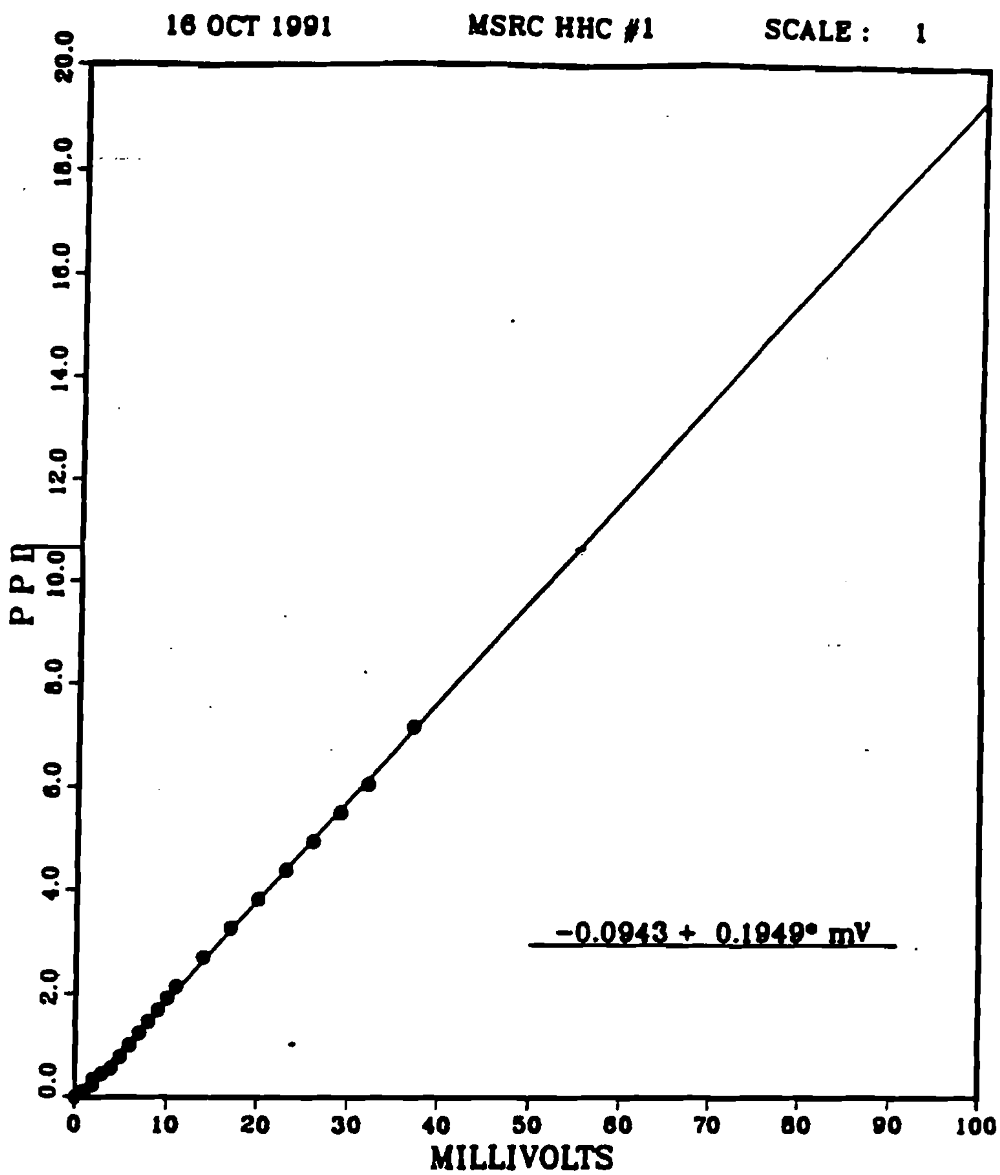
FLUOROMETER CALIBRATION

Prepared For:

BAYWAY REFINING COMPANY
LINDEN, NEW JERSEY
JUNE 1994

PROJECT NO.	FILE NO.	CHK'D: / ENG. / APPVD.	DRAWING NUMBER	REV. NO.
542110	A3		542110-A3	

542010A3 06/07/94 0:41pm EDDY K. WU



REV. NO.	DATE	DESCRIPTION OF REVISION	REV. BY	ENG	CHKD BY	APPVD BY

PROJECT MANAGER: N. MURRAY DRAWN BY: E.W. DATED: 6/7/94

INTERNATIONAL TECHNOLOGY CORPORATION

FIGURE 6

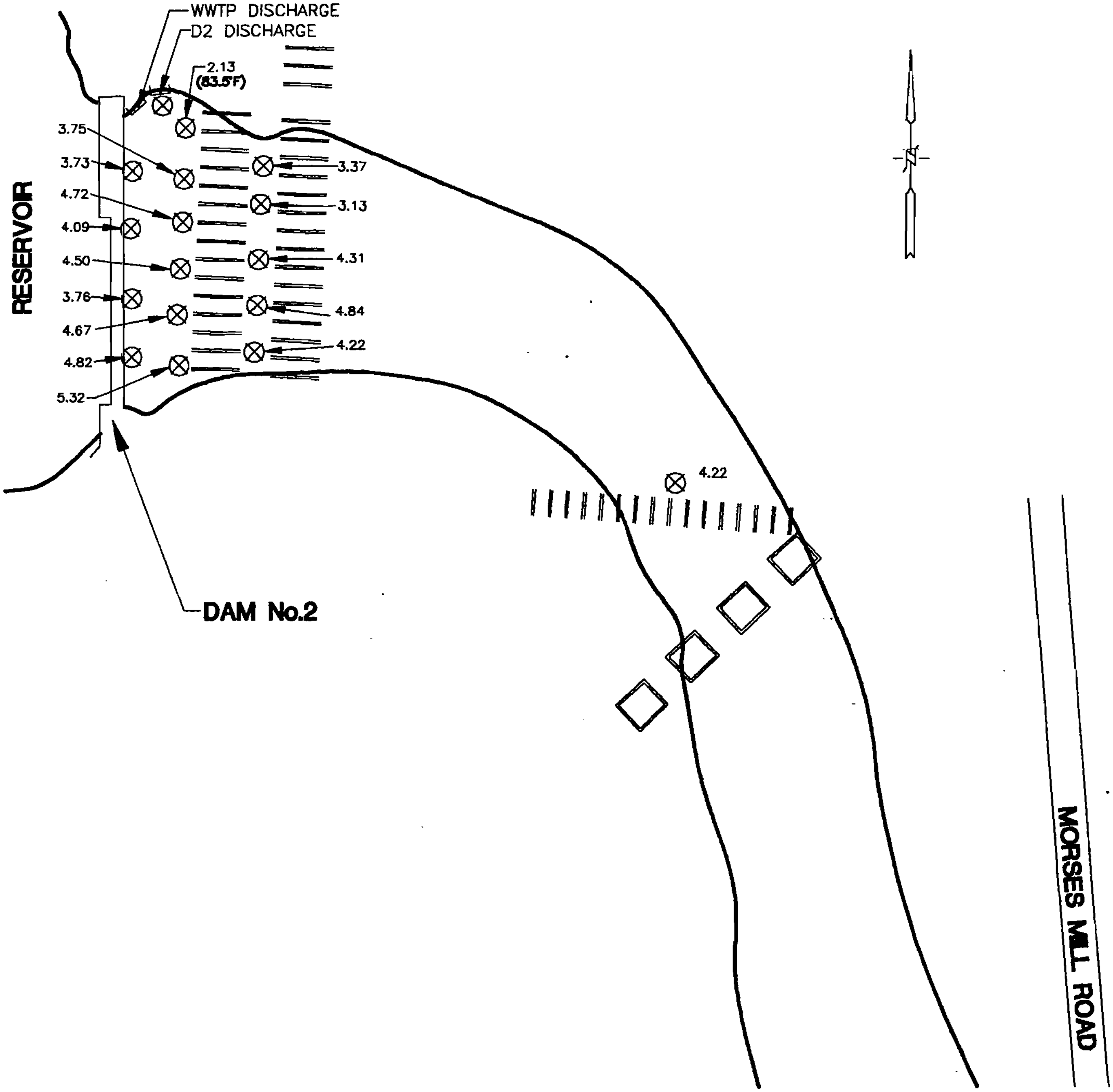
FLUOROMETER CALIBRATION

Prepared For:

BAYWAY REFINING COMPANY
LINDEN, NEW JERSEY
JUNE 1994

PROJECT NO.	FILE NO.	CHK'D / ENG. / APPVD.	DRAWING NUMBER	REV. NO.
542110	A3		542110-A3	

542010A3 06/07/94 0:41pm EDDY K. WU



LEGEND:

3.37 ⊗ (82.0°F) DILUTION AND TEMPERATURE SAMPLING LOCATION

550 0 550 110

SCALE OF FEET

REV. NO.	DATE	DESCRIPTION OF REVISION	REV. BY	ENG	CHKD BY	APPVD BY
0	6/10/94	DEVELOPED DRAWING	E.W.			

PROJECT MANAGER: M. MURRAY | DRAWN BY: M.S.M. | DATE: 11/11/91

INTERNATIONAL TECHNOLOGY CORPORATION

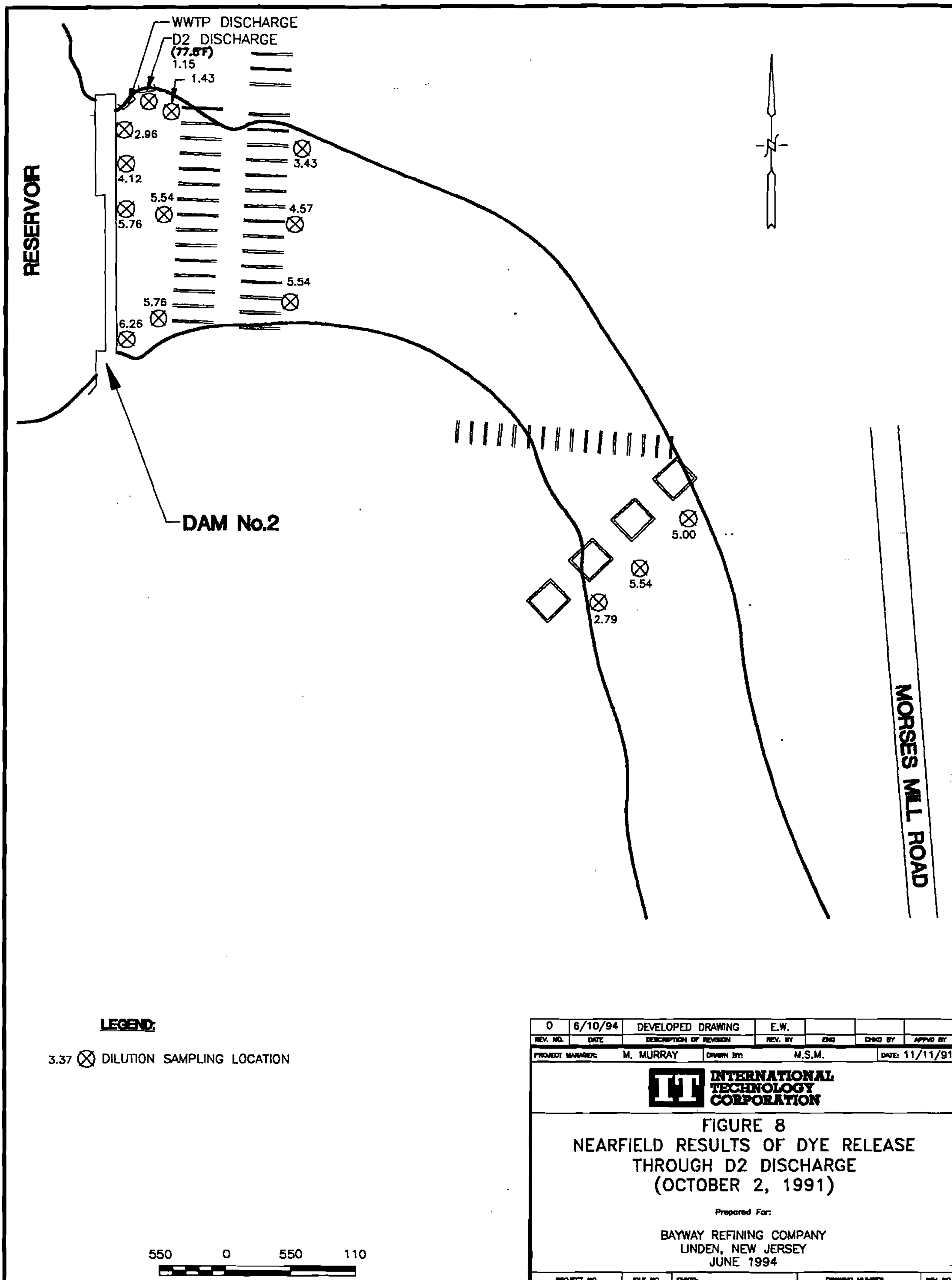
FIGURE 7
NEARFIELD RESULTS OF DYE RELEASE THROUGH WASTEWATER TREATMENT PLANT EFFLUENT (SEPTEMBER 27, 1991)

Prepared For:

BAYWAY REFINING COMPANY
LINDEN, NEW JERSEY
JUNE 1994

PROJECT NO.	FILE NO.	CHK'D: / ENG. / APPVD.	DRAWING NUMBER	REV. NO.
542110	A5		542110-A5	

542010A5 06/10/94 9:05am EDDY K. WU



REV. NO.	DATE	DESCRIPTION OF REVISION	REV. BY	ENG	CHKD BY	APPVD BY
0	6/10/94	DEVELOPED DRAWING	E.W.			

PROJECT MANAGER: M. MURRAY | DRAWN BY: M.S.M. | DATE: 11/11/91

INTERNATIONAL TECHNOLOGY CORPORATION

FIGURE 8
NEARFIELD RESULTS OF DYE RELEASE THROUGH D2 DISCHARGE (OCTOBER 2, 1991)

Prepared For:

BAYWAY REFINING COMPANY
LINDEN, NEW JERSEY
JUNE 1994

PROJECT NO.	FILE NO.	CHK'D: / ENG: / APPVD:	DRAWING NUMBER	REV. NO.
542110	A6		542110-A6	

542110A6 06/28/94 7:34am EDDY K. WU

DILUTION
MULTIPLY ALL VALUES BY 1.000E-02

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60	9998	9998	9998	9998	9998	9998	9998	9998	9998	9998	9998	9998	100	9998
59	9998	317	317	319	315	311	307	301	269	246	202	187	147	212
58	9998	321	323	324	321	319	312	297	280	297	266	231	168	215
57	9998	330	331	331	329	328	323	316	305	302	321	344	330	469
56	9998	339	337	335	331	328	323	317	301	271	255	261	284	361
55	9998	340	339	337	333	328	326	322	312	301	286	279	288	313
54	9998	342	341	337	326	312	313	317	318	321	300	295	329	364
53	9998	343	342	339	333	325	326	331	335	336	318	322	342	360
52	9998	343	343	343	342	340	340	342	345	336	324	329	353	361
51	9998	342	342	342	343	343	345	347	347	343	340	332	339	342
50	9998	341	341	342	343	345	347	350	352	350	343	329	330	342
49	9998	342	343	344	345	347	350	353	355	355	351	339	325	341
48	9998	343	344	345	347	348	351	353	356	357	356	349	337	344
47	9998	345	345	347	348	350	352	355	357	359	358	354	350	352
46	9998	345	346	348	350	353	356	358	360	361	359	356	354	355
45	9998	346	347	349	352	355	358	361	362	363	361	358	355	355
44	9998	347	348	350	353	357	360	363	365	365	364	361	356	354
43	9998	347	349	351	353	356	360	363	366	367	367	364	359	355
42	9998	348	349	351	353	355	359	362	365	368	368	366	362	358
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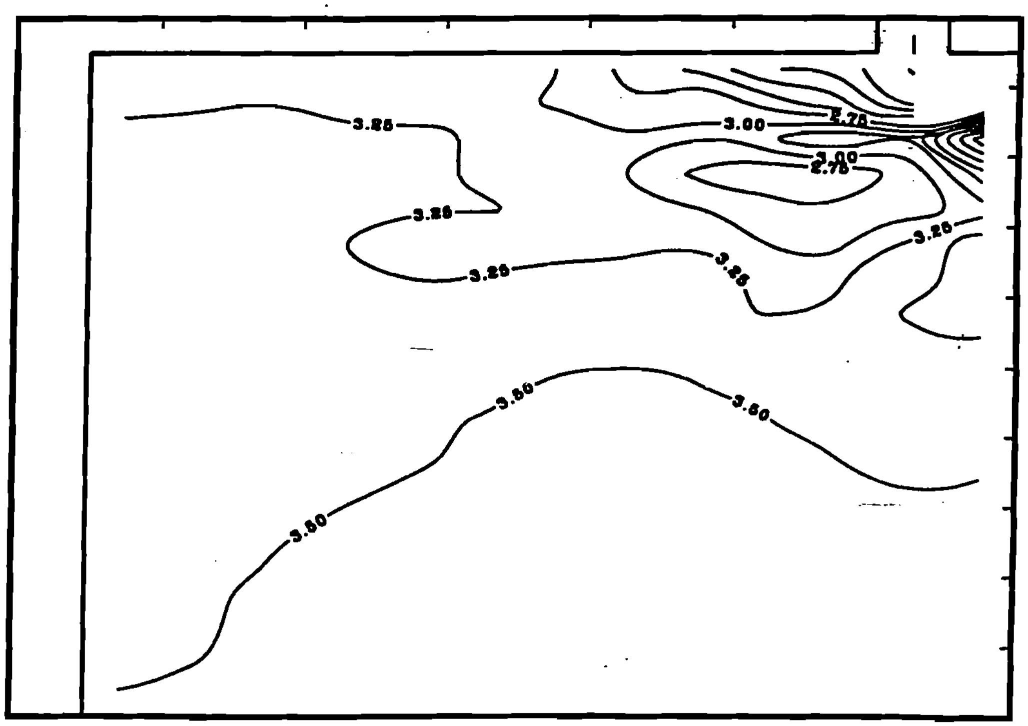

REV. NO.	DATE	DESCRIPTION OF REVISION	REV. BY	ENG	CHKD BY	APPVD BY

PROJECT MANAGER: M. MURRAY DRAWN BY: E.W. DATE: 6/7/94

INTERNATIONAL TECHNOLOGY CORPORATION

FIGURE 9
DILUTION ISOPLETHS
SIMULATION OF CONDITIONS
ON SEPTEMBER 27, 1991

BAYWAY REFINING COMPANY
LINDEN, NEW JERSEY
JUNE 1994

PROJECT NO.	FILE NO.	CHK'D: / ENG. / APPVD.	DRAWING NUMBER	REV. NO.
542110	A3		542110-A3	

DILUTION
MULTIPLY ALL VALUES BY 1.000E-02

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59	9998	337	325	312	314	325	317	328	301	260	214	227	232	453
58	9998	349	341	334	349	363	346	374	358	341	252	274	370	535
57	9998	397	395	380	404	420	434	450	425	410	343	336	435	543
56	9998	422	423	419	445	455	469	478	472	471	462	436	547	619
55	9998	440	473	508	485	467	495	499	496	493	477	506	587	567
54	9998	436	451	478	495	473	471	480	494	487	483	503	501	557
53	9998	435	437	445	453	445	455	469	483	495	500	508	529	584
52	9998	445	445	445	451	459	465	473	487	508	519	521	529	532
51	9998	463	458	458	463	470	470	473	478	483	490	507	559	609
50	9998	475	470	473	470	477	477	477	481	488	505	532	558	578
49	9998	483	482	483	481	485	485	483	485	490	500	519	537	554
48	9998	488	488	489	489	489	488	486	486	488	492	500	512	527
47	9998	491	492	492	492	492	491	489	489	492	497	505	519	535
46	9998	494	494	495	495	495	493	491	490	494	499	510	529	549
45	9998	495	496	497	497	497	497	495	494	498	503	512	528	548
44	9998	498	499	499	500	500	499	499	499	502	506	515	529	543
43	9998	502	502	503	503	503	502	501	501	502	506	513	524	539
42	9998	506	506	506	506	506	505	504	503	503	504	508	516	531
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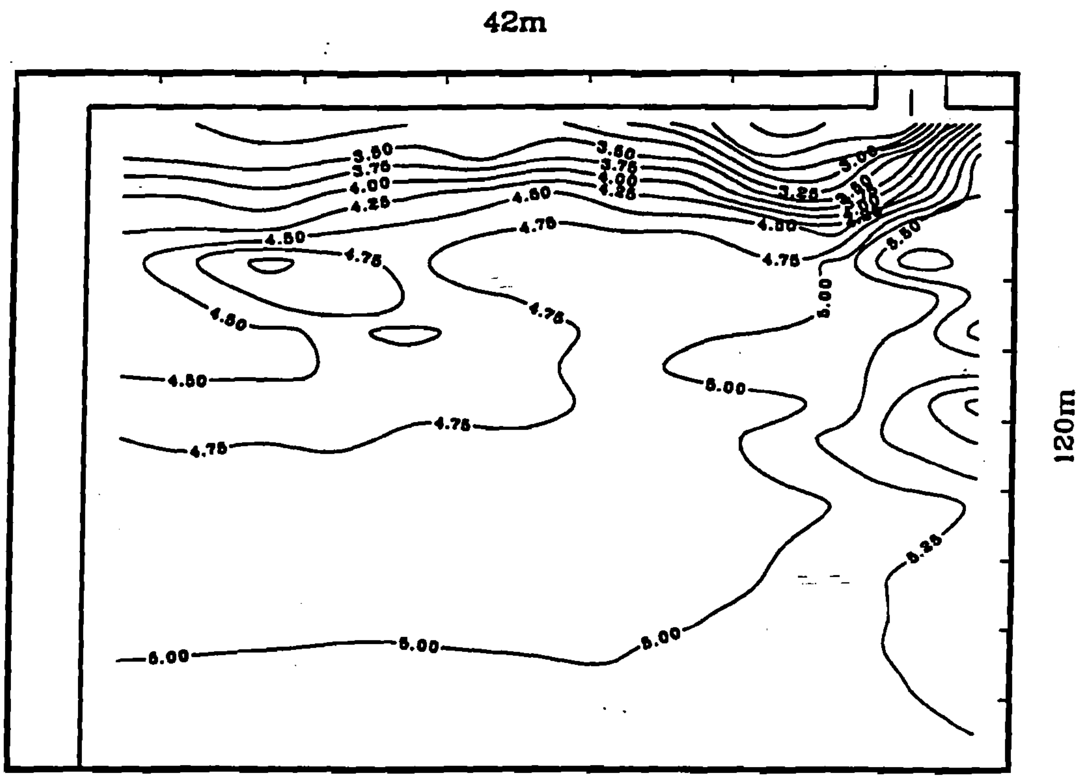

REV. NO.	DATE	DESCRIPTION OF REVISION	REV. BY	ENG	CHKD BY	APPVD BY

PROJECT MANAGER: M. MURRAY DRAWN BY: E.W. DATE: 6/7/94

INTERNATIONAL TECHNOLOGY CORPORATION

FIGURE 10
DILUTION ISOPLETHS
SIMULATION OF CONDITIONS
ON OCTOBER 2, 1991

BAYWAY REFINING COMPANY
LINDEN, NEW JERSEY
JUNE 1994

PROJECT NO.	FILE NO.	CHK'D: / ENG. / APPVD.	DRAWING NUMBER	REV. NO.
542110	A3		542110-A3	

542110A3 06/27/94 3:25pm EDDY K. WU

DILUTION
MULTIPLY ALL VALUES BY 1.000E-02

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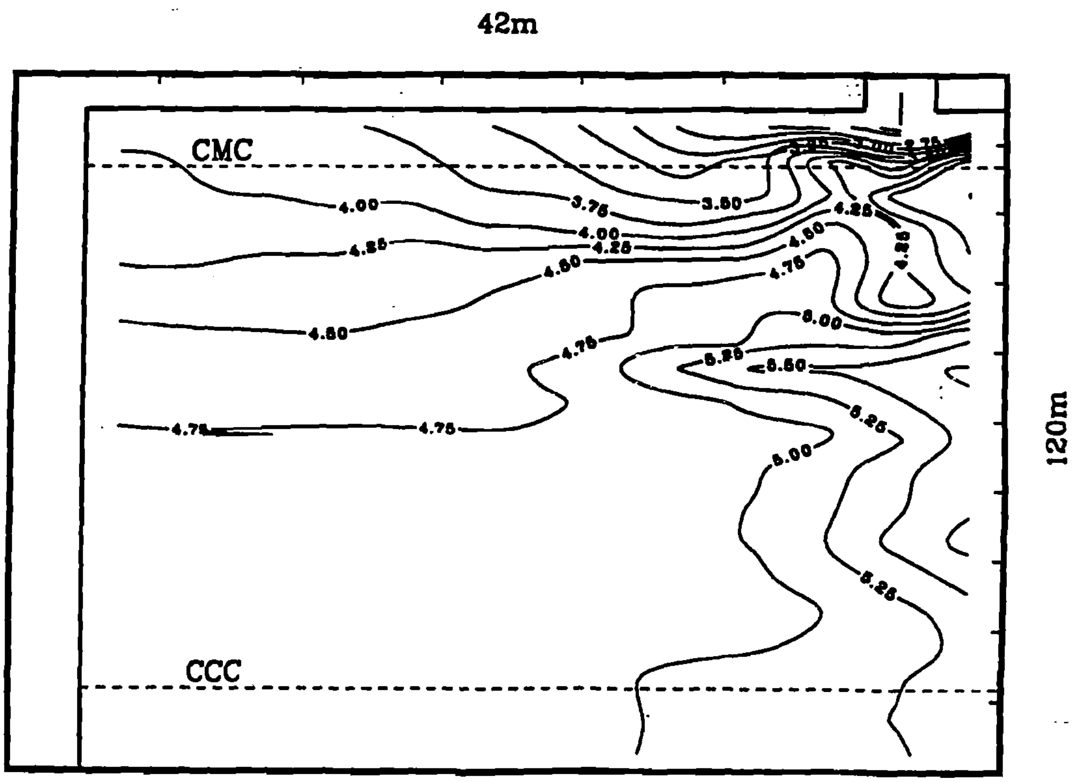
59	9998	394	391	389	379	368	353	338	310	269	250	245	182	237
58	9998	402	399	396	389	382	366	355	332	309	338	426	375	485
57	9998	403	400	399	393	394	378	375	353	342	344	396	489	609
56	9998	410	411	415	411	417	404	400	391	380	402	462	423	486
55	9998	424	424	428	430	439	442	446	456	461	466	483	422	468
54	9998	442	440	439	439	444	449	459	471	484	497	480	406	444
53	9998	453	451	451	450	453	457	464	472	484	501	512	508	544
52	9998	461	462	462	461	462	465	477	497	528	553	552	567	578
51	9998	470	470	470	470	469	469	472	479	491	505	519	545	570
50	9998	477	476	477	477	477	476	477	478	481	488	499	522	559
49	9998	482	481	482	482	483	482	482	484	489	498	515	542	573
48	9998	486	485	486	486	486	486	486	487	491	501	521	547	572
47	9998	489	489	489	489	489	489	489	489	492	501	525	557	582
46	9998	492	491	491	492	492	492	492	492	492	496	509	534	559
45	9998	494	493	493	493	493	494	494	495	495	495	500	515	537
44	9998	495	495	495	494	494	495	496	497	498	499	502	513	531
43	9998	496	496	496	495	495	495	496	498	501	505	510	522	539
42	9998	497	497	496	496	495	496	496	498	501	505	513	526	544
41	9998	498	497	497	496	496	496	497	499	501	505	511	521	538



REV. NO.	DATE	DESCRIPTION OF REVISION	REV. BY	ENG	CHKD BY	APPVD BY

PROJECT MANAGER: M. MURRAY DRAWN BY: E.W. DATE: 6/7/94

INTERNATIONAL TECHNOLOGY CORPORATION

FIGURE 11
DILUTION ISOPLETHS
SIMULATION OF
CRITICAL CONDITIONS

BAYWAY REFINING COMPANY
LINDEN, NEW JERSEY
JUNE 1994

PROJECT NO.	FILE NO.	CHKD. / ENG. / APPVD.	DRAWING NUMBER	REV. NO.
542110	A3		542110-A3	

542110A3 06/27/94 3:26pm EDDY K. WU

RECEIVED
#1
JAN 24 '92
STATE OF NEW JERSEY
DEPT. ENVIRONMENTAL PROTECTION
DIVISION WATER RESOURCES
BUR. OF IND. WASTE MGMT.

CARLIN, MADDOCK, FAY & CERBONE, P.C.
COUNSELORS AT LAW
30 VREELAND ROAD
P.O. BOX 751
FLORHAM PARK, NEW JERSEY 07932

(201) 377-3350
FAX (201) 377-5626

JOHN J. CARLIN, JR.
LAURENCE R. MADDOCK
DONALD J. FAY
RICHARD R. CERBONE
ARTHUR G. WARDEN, III

January 17, 1992

Commissioner Scott Weiner
New Jersey Department of
Environmental Protection and Energy
401 East State Street
Trenton, New Jersey 08625

Re: Petition for Public Hearing
Pursuant to N.J.S. 58:10A-8

Dear Commissioner Weiner:

Enclosed please find Request for Public Hearing on behalf of Local 877 and Bayway Employees Salary Union regarding Exxon's discharges into Morses Creek.

Very truly yours,

CARLIN, MADDOCK, FAY & CERBONE, P.C.

By J. Carl

JJC,JR:ja
Enclosure
cc: Nancy Stiles, DAG
Cari Jackson Wild, DAG

REQUEST FOR PUBLIC HEARING PURSUANT
TO N.J.S. 58:10A-8

To: Commissioner Scott A. Weiner
New Jersey Department of Environment Protection

1. Within the City of Linden, Exxon Company, U.S.A., a division of Exxon Corporation (hereinafter "Exxon") operates a petroleum refinery, known as the Bayway Refinery.

2. Local 877 and the Bayway Employees Salary Union ("BESU") are labor organizations which are the collective bargaining representatives of the represented employees of Exxon at the Bayway Refinery.

3. Since the inception of the Refinery in 1909, Exxon has discharged its once through cooling water pumped in from the Arthur Kill into Morses Creek, a small tidal inlet located almost entirely within the confines of the Bayway Refinery.

4. We understand that the continued use of Morses Creek for the discharge of the once thru cooling water, treated process water and storm water runoff is vital to the continuing of refining operations at Bayway.

5. In 1985, Exxon submitted to the DEP a conditional application for a reclassification of the Tidal Portion of Morses Creek in order to continue the use of its cooling water system. This application was not acted upon by the DEP.

6. In 1989, Exxon again submitted to the DEP a conditional application for reclassification.

7. We are informed that on December 3, 1990, the DEP denied

Exxon's request for reclassification and announced its intention to issue a draft renewal permit for Exxon's discharge which would incorporate more stringent water quality based effluent limitations necessary to achieve the designated water quality standards in Morses Creek.

8. As stated on page 35 in the documentation which accompanied the decision of the DEP, Exxon's discharges into Morses Creek are currently meeting the effluent limitation required by Section 301(b) and 306 of the federal Clean Water Act.

9. N.J.S. 58:10A-8 provides:

> "Whenever the commissioner finds that discharges from a point source or a group of point sources with the application of the effluent limitations authorized in this act, which effluent limitations are as stringent as the best available technology economically achievable as provided for in the Federal Act or State law, would interfere with the attainment and maintenance of applicable water quality standards, the commissioner may establish more stringent effluent limitations for each such point source or group of point sources, which effluent limitations can reasonably be expected to contribute to the attainment and maintenance of the applicable water quality standards. Prior to the establishment of any more stringent effluent limitations under this section, the commissioner shall publish a notice of his intent to establish such limitations and, upon request of a person affected by any such limitations, the commissioner shall hold a public hearing to determine if there is a reasonable relationship between the economic and social costs of achieving such limitations, including any economic or social dislocation in the affected community or communities, and the social and environmental benefits to be obtained, including the objective of restoring and maintaining the water quality of the State, and to determine whether such effluent limitations can be implemented with available technology or with other control strategies. If a person

> affected by any such limitations demonstrates at the hearing that there is no reasonable relationship between the economic and social costs of compliance and the benefits to be obtained, the commissioner shall modify any such limitations as they may apply to that person."

10. Exxon has taken the position that the imposition of effluent limits on its discharge into Morses Creek which are more stringent than required under the federal Clean Water Act could result in the cessation of refining operations at Bayway. This result would have an adverse social and economic affect on the community of Linden.

11. Local 877 and the BESU are persons affected by the more stringent effluent limitations which the DEP intends to establish for Exxon's discharges into Morses Creek.

WHEREFORE, Local 877 and the BESU request that you hold a public hearing to determine:

1. If there is a reasonable relationship between the economic and social costs of achieving more stringent effluent limitations for Exxon's discharges into Morses Creek, including any economic or social dislocation in the affected community or communities, and the social and environmental benefits to be obtained therefrom; and

2. Whether such effluent limitations can be implemented with available technology or with other control strategies.

Respectfully submitted,

LOCAL 877

By Ronald E. Fonseca

BAYWAY EMPLOYEES SALARY UNION

By John Braniа

Cay-0616
-Shirs
Marty Burbank

HWM
WR

Refinery jobs may be lost

Water rules could trigger closing

By SUZANNE C. RUSSELL
News Tribune Staff Writer

LINDEN When city officials look at Exxon's Bayway refinery, they see hundreds and hundreds of jobs and they see millions and millions of tax dollars.

So they are ready to do a little pleading with the state to keep Exxon, the city's largest taxpayer, in Linden.

New state restrictions on how the refinery discharges water into Morses Creek could force the company to add $100 million in equipment.

Or, city officials fear, erase all those jobs and tax dollars by simply closing up shop.

City Engineer Edward J. Kologi said the Linden will ask the state Department of Environmental Protection and Energy to conduct a public hearing on Exxon's water discharge into Morses Creek.

As part of its daily operations at the Bayway Refinery, Exxon draws water from the Arthur Kill to cool its processing refinery units and then discharges warm water into the 1.7-mile Morses Creek, which is on company property, Al Kapkowski, an Exxon spokesman, said.

In 1985 and 1989, when the state was adopting more stringent water regulations, Exxon asked the DEPE to continue to classify the creek as industrial, Kapkowski said.

Instead the state, in 1990, reclassifed the creek from industrial to recreational, a category that has stricter water quality standards.

See **LINDEN** Page **B-2**

Continued from Page B-1

The reclassification of the creek would prevent Exxon from discharging water into the creek and force the company to seek alternative methods.

Kapkowski said the DEPE is concerned because the water is warm when it is discharged back into the creek. He did not know the exact temperature of the water.

He added the discharged water cannot meet the maximum water temperatures mandated by the DEPE's proposal without costly treatment systems to make it cooler.

"I have personally seen steam off Morses Creek three to four feet in the air," said Beatrice Bernzott, president of the Concerned Citizens of Linden. "They have murdered thousands of birds and fish with water so hot. They used it as a industrial sewer, and now they are asking permission after the fact.

Kapkowski said Exxon filed a motion in court requesting a public hearing on the DEPE decision, a move he said was endorsed by the city.

"If Exxon has to do this, it could cause them to close the Bayway Refinery. If they can't use the water, they would have to shut down the operation. The impact would be devastating," Kologi said.

Closing the company would result in the loss of $8 million a year in taxes which would have to be made up by local taxpayers, officials said.

"Exxon employs over 850 individuals and contributes over $8 million to our local tax base," said Councilman Charles Crane, liaison to the environmental commission.

"It is, therefore, in the city's interest to petition the DEPE for a public hearing to determine if there is a reasonable relationship between the economic and social costs of achieving more stringent limitation for Exxon's discharges into Morses Creek, and whether such limitation can be implemented with available technology and control strategies," Crane said.

Kapkowski said the state's position would force Exxon to spend $100 million for new equipment if the company cannot discharge water into the creek.

"Under the classification specified in the December 1990 DEPE decision, extensive new facilities costing $100 million in additional annual operating cost would be required for the refinery to continue operation," he said.

"In spite of the high cost, these new facilities would provide no real environmental benefit and would clearly jeopardize Bayway's economic viability. For this reason, Exxon will continue to seek a solution which offers a better balance between cost and benefit," Kapkowski said.

"They have been threatening to move out for years, and I've been offering to help them pack. I'm not trying to chase them out of town, I just want them to get up to snuff and obey all the rules and regulations. Exxon is not going anywhere and they should pay the cost of doing work in New Jersey," Bernzott said.

Andrew Willner, bay keeper of the New York/New Jersey Harbor for the American Littoral Society in Sandy Hook, a national conservation organization involved in coastal issues, said Exxon is petitioning the state to downgrade the creek.

"Exxon requested the water-quality standard be dropped, and we're opposed to it because Morses Creek is not only a place for fish to hang out but a place with prey [bird] species in abundance looking for fish," he said, adding that there are a variety of fresh and salt water fish in the area.

He said a state agency should not relax standards for improving the quality of waterways to meet the needs of a particular landowner.

"There are some fish in there but not many," said City Engineer John Ziemian. "I'm 64-years-old and lived in Linden all my life, and nobody's ever been fishing there. Besides, the creek is blocked by dams, which have been there before I was born."

DEPE officials could not be reached for comment last night.

C
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FRIDAY, JANUARY 24, 1992
THE NEWS TRIBUNE

rubber stamps
Exxon's
language

MANHAS

Bayway **R**efining **C**ompany
a subsidiary of Tosco Corporation
1400 Park Avenue
Linden, New Jersey 07036

Thomas J. Nimbley
Vice President and
Refinery Manager

July 19, 1993

Quarterly Progress Report
NJPDES-DSW Permit No. NJ0001511

New Jersey Department of Environmental Protection and Energy
Wastewater Facilities Regulation Program
Bureau of Industrial Discharge Permits
CN 029
Trenton, New Jersey 08625-0029

This is the quarterly progress report on the status of work conducted, as required by NJPDES-DSW Permit No. NJ0001511, Part IV-Characterization, Paragraph 2D. It covers the period of 5/1/93 to 7/31/93.

Monthly effluent characterization sampling for the 3 once through cooling water discharges into Morses Creek designated #2 Dam, Poly Ditch and R.R. Ave. Ditch, has been completed for the 3 months. The results for May and June are attached [Attachment 1]. Analyses of the June sample for Poly Ditch have not been completed by the laboratory. Completed data for this sample will be included in the next quarterly report, along with the data for July. Also included are results from a water discharge from one of our butane spheres, 194 sphere, into Morses Creek. This procedure was outlined in a letter to Mr. Ben Manhas, dated June 22, 1993.

Chronic Toxicity Characterization Study testing has been completed for the 1st quarter of the permit year. Bayway Refinery has chosen to conduct the study using both of the fish species allowed by the permit, the Sheepshead Minnow [Cyrinodon Variegatus], and the Inland Silverside [Menidia beryllina], in addition to the Mysid Shrimp [Mysidopsis bahia]. Two laboratories are performing the tests, since no laboratory has satisfied the SRT requirements for Chronic Toxicity Testing for both of the fish species. Results from the test conducted, 6/25/93 to 7/2/93, are attached [Attachment 2].

Monthly sampling of the stormwater discharges to Morses Creek for May, June, and as of this date July have not been completed. This is due to the lack of a qualifying rainstorm, i.e. > 0.1 inches of rain preceded by 72 hours of dry weather, and not varying by more than 50% from the annual average rainfall volume and duration, occurring during reasonable hours when samples could be taken. The rain events, to date, have been either short duration, severe thunderstorms, or have occurred late at night or on weekends and holidays, when sampling was not practical. A log of rainfall is attached [Attachment 3]. The refinery will continue to take measures to meet this sampling requirement. Also, the refinery will collect more than one sample per month, if the opportunity arises, through the remainder of the study period, in order to compile 12 sets of data, although they will not then be monthly.

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This report is certified pursuant to N.J.A.C. 7:14A-2.4, and the certification is made subject to the statutory provisions of the N.J.S.A. 2C:28-3[a]. I certify, under penalty of law that I have personally examined and am familiar with the information submitted in this and all attached documents, and that the attached documents were prepared by personnel under my direction or supervision in accordance with a system designed to assure that qualified personnel properly gather and evaluate the information submitted. Based on my inquiry of those individuals immediately responsible for obtaining the information, I believe that the submitted information is true, accurate, and complete. I am aware that there are significant civil and criminal penalties for submitting false, inaccurate or incomplete information, including the possibility of fine and/or imprisonment.

Please contact Rich Klawunn at [908] 523-6089 if you have any questions or require further information.

Very truly yours,

TJNimbley
caw JMB

T. J. Nimbley
Vice President & Refinery Manager

REK:mt
Attachments

MARGARITA ZINNO
NOTARY PUBLIC OF NEW JERSEY
My Commission Expires April 28, 1998

Margarita Zinno

<REK\qtrprog.rep>

ATTACHMENT 1

BAYWAY REFINERY
EFFLUENT CHARACTERIZATION
NJPDES PERMIT NO. NJ0001511

QUALIFIERS

U - Indicates that the compound was analyzed for but not detected

J - Indicates that the compound was analyzed for and determined to be present in the sample. The mass spectrum of the compound meets the identification criteria of the method. The concentration listed is an estimated value which is less than the specified minimum detection limit but is greater than zero.

B - This flag is used when the analyte is found in the blanks as well as the sample. It indicates possible sample contamination and warns the data user to use caution when applying the results of this analyte.

ND - Not Detected

BMDL - Below Method Detection Limit, the value below which the parameter cannot be accurately quantified.

'@ - Parameter was not analyzed for by laboratory

N/A - Not applicable to this sample

ATTACHMENT 1

BAYWAY REFINERY
EFFLUENT CHARACTERIZATION
NJPDES PERMIT NO. NJ0001511

	#2 DAM 5/26/93	#2 DAM 6/23/93	Poly-Ditch 5/26/93	Poly-Ditch 6/28/93
Pesticides, ug/L				
Alpha-BHC	U	U	U	
Beta-BHC	U	U	U	
Delta-BHC	U	U	U	
Gamma-BHC	U	U	U	
Heptachlor	U	U	U	
Aldrin	U	U	U	
Heptachlor Epoxide	U	U	U	
Endosulfan I	U	U	U	
Dieldrin	U	U	U	
4,4'-DDE	U	U	U	
Endrin	U	U	U	
4,4'-DDD	U	U	U	
4,4'-DDT	U	U	U	
Endrin Aldehyde	U	U	U	
Endosulfan II	U	U	U	
Endosulfan Sulfate	U	U	U	
Methoxychlor	U	U	U	
Chlordane	U	U	U	
Toxaphene	U	U	U	
Metals, ug/L				
Antimony	ND	BMDL	ND	
Arsenic	ND	BMDL	ND	
Beryllium	ND	BMDL	ND	
Cadmium	ND	66	ND	BMDL
Chromium	ND	BMDL	ND	BMDL
Chromium +6	ND	BMDL	ND	BMDL
Copper	ND	64	ND	46
Lead	ND	270	ND	
Mercury	ND	BMDL	ND	
Nickel	ND	219	ND	168
Selenium	ND	BMDL	ND	BMDL
Silver	ND	BMDL	ND	BMDL
Thallium	ND	BMDL	ND	
Zinc	ND	78	ND	44

BAYWAY REFINERY
EFFLUENT CHARACTERIZATION
NJPDES PERMIT NO. NJ0001511

	#2 DAM 5/26/93	#2 DAM 6/23/93	Poly-Ditch 5/26/93	Poly-Ditch 6/28/93
Acid/Base Neutrals, ug/L				
Acenaphthene	U	U	U	U
Acenaphthylene	U	U	U	U
Anthracene	U	U	U	U
Benzidene	U	U	U	U
Benzo(a)Anthracene	U	U	U	U
Benzo(b)Fluoranthene	U	U	U	U
Benzo(k)Fluoranthene	U	U	U	U
Benzo(a)Pyrene	U	U	U	U
Benzo(g,h,i)Perylene	U	U	U	U
bis(2-Chloroethyl)Ether	U	U	U	U
bis(2-Chloroethoxy)Methane	U	U	U	U
bis(2-Ethylhexyl)Phthalate	U	10	U	2
bis(2-Chloroisopropyl)Ether	U	U	U	U
4-Bromophenyl Phenyl Ether	U	U	U	U
Butyl Benzyl Phthalate	U	U	U	U
2-Chloronaphthalene	U	U	U	U
4-Chlorophenyl Phenyl Ether	U	U	U	U
Chrysene	U	U	U	U
Dibenzo(a,h)anthracene	U	U	U	U
Di-n-butylphthalate	U	U	U	U
1,2-Dichlorobenzene	U	U	U	U
1,3-Dichlorobenzene	U	U	U	U
1,4-Dichlorobenzene	U	U	U	U
3,3'-Dichlorobenzidene	U	U	U	U
Diethylphthalate	U	U	U	U
Dimethylphthalate	U	U	U	U
2,4-Dinitrotoluene	U	U	U	U
2,6-Dinitrotoluene	U	U	U	U
Di-n-Octylphthalate	U	U	U	U
1,2-Diphenylhydrazine	U	U	U	U
Fluoranthene	U	U	U	U
Fluorene	U	U	U	U
Hexachlorobenzene	U	U	U	U
Hexachlorobutadiene	U	U	U	U
Hexachloroethane	U	U	U	U
Hexachlorocyclopentadiene	U	U	U	U
Indeno(123-cd)pyrene	U	U	U	U
Isophorone	U	U	U	U
Naphthalene	U	U	U	U

BAYWAY REFINERY
EFFLUENT CHARACTERIZATION
NJPDES PERMIT NO. NJ0001511

	#2 DAM 5/26/93	#2 DAM 6/23/93	Poly-Ditch 5/26/93	Poly-Ditch 6/28/93
Nitrobenzene	U	U	U	U
N-Nitoso-dimethylamine	U	U	U	U
N-Nitrosodi-n-propylamine	U	U	U	U
N-Nitrosodiphenylamine	U	U	U	U
Phenanthrene	U	U	U	U
Pyrene	U	U	U	U
1,2,4-Trichlorobenzene	U	U	U	U
4-Chloro-3-methylphenol	U	U	U	U
2-Chlorophenol	U	U	U	U
2,4-Dichlorophenol	U	U	U	U
2,4-Dimethylphenol	U	U	U	U
2,4-Dinitrophenol	U	U	U	U
4,6-Dinitro-2-methylphenol	U	U	U	U
2-Nitrophenol	U	U	U	U
4-Nitrophenol	U	U	U	U
Pentachlorophenol	U	U	U	U
Phenol	U	U	U	U
2,4,6-Trichlorophenol	U	U	U	U
Volatile Organics, ug/L				
Acrolein	U	U	U	U
Acrylonitrile	U	U	U	U
Benzene	U	17	130	U
Bromoform	U	U	U	18
Bromomethane	U	U	U	U
Carbon Tetrachloride	U	U	U	U
Chlorobenzene	U	U	U	U
Chlorodibromobenzene	U	U	U	U
Chloroethane	U	U	U	U
2-Chloroethylvinyl Ether	U	U	U	U
Chloroform	6	U	U	U
Chloromethane	U	U	U	U
Dichlorobromomethane	U	U	U	U
1,1-Dichloroethane	U	U	U	U
1,2-Dichloroethane	U	U	U	U
1,1-Dichloroethene	U	U	U	U
trans-1,2-Dichloroethene	U	U	U	U
1,2-Dichloropropane	U	U	U	U
cis-1,3-Dichloropropene	U	U	U	U
trans-1,3-Dichloropropene	U	U	U	U

BAYWAY REFINERY
EFFLUENT CHARACTERIZATION
NJPDES PERMIT NO. NJ0001511

	#2 DAM 5/26/93	#2 DAM 6/23/93	Poly-Ditch 5/26/93	Poly-Ditch 6/28/93
Ethylbenzene	U	7	U	U
Methylene Chloride	U	4 J	U	1 J
1,1,2,2-Tetrachloroethane	U	U	U	U
Tetrachloroethene	U	U	U	U
Toluene	U	49	19	U
1,1,1-Trichloroethane	U	U	U	U
1,1,2-Trichloroethane	U	U	U	U
Trichloroethene	U	U	U	U
Trichlorofluoromethane	U	U	U	U
Vinyl Chloride	U	U	U	U
Parameter, mg/L				
Ammonia-N	0.16	0.715	0.33	0.824
BOD5	ND	BMDL	9.3	4.1
COD	130	95.8	120	44.4
TPHC	ND	1.78	ND	BMDL
Total Phenols	ND	0.025	0.17	0.019
Sulfide	ND	BMDL	ND	BMDL
TSS	25	30.9	27	12.8
Temperature, deg. C	22.3	28.3	19.5	26.5

BAYWAY REFINERY
EFFLUENT CHARACTERIZATION
NJPDES PERMIT NO. NJ0001511

	RRAv-Ditch 5/26/93	RRAv-Ditch 6/23/93	194 Sphere 6/10/93
Pesticides, ug/L			
Alpha-BHC	U	U	U
Beta-BHC	U	U	U
Delta-BHC	U	U	U
Gamma-BHC	U	U	U
Heptachlor	U	U	U
Aldrin	U	U	U
Heptachlor Epoxide	U	U	U
Endosulfan I	U	U	U
Dieldrin	U	U	U
4,4'-DDE	U	U	U
Endrin	U	U	U
4,4'-DDD	U	U	U
4,4'-DDT	U	U	U
Endrin Aldehyde	U	U	U
Endosulfan II	U	U	U
Endosulfan Sulfate	U	U	U
Methoxychlor	U	U	@
Chlordane	U	U	U
Toxaphene	U	U	U
Metals, ug/L			
Antimony	ND	BMDL	BMDL
Arsenic	ND	BMDL	BMDL
Beryllium	ND	BMDL	BMDL
Cadmium	ND	69	BMDL
Chromium	ND	BMDL	BMDL
Chromium +6	ND	BMDL	BMDL
Copper	ND	65	BMDL
Lead	ND	290	4.2
Mercury	ND	BMDL	BMDL
Nickel	ND	217	BMDL
Selenium	ND	BMDL	BMDL
Silver	ND	BMDL	BMDL
Thallium	ND	BMDL	BMDL
Zinc	ND	76	156

BAYWAY REFINERY
EFFLUENT CHARACTERIZATION
NJPDES PERMIT NO. NJ0001511

	RRAv-Ditch 5/26/93	RRAv-Ditch 6/23/93	194 Sphere 6/10/93
Acid/Base Neutrals, ug/L			
Acenaphthene	U	U	U
Acenaphthylene	U	U	U
Anthracene	U	U	U
Benzidene	U	U	U
Benzo(a)Anthracene	U	U	U
Benzo(b)Fluoranthene	U	U	U
Benzo(k)Fluoranthene	U	U	U
Benzo(a)Pyrene	U	U	U
Benzo(g,h,i)Perylene	U	U	U
bis(2-Chloroethyl)Ether	U	U	U
bis(2-Chloroethoxy)Methane	U	U	U
bis(2-Ethylhexyl)Phthalate	U	13	27
bis(2-Chloroisopropyl)Ether	U	U	U
4-Bromophenyl Phenyl Ether	U	U	U
Butyl Benzyl Phthalate	U	U	U
2-Chloronaphthalene	U	U	U
4-Chlorophenyl Phenyl Ether	U	U	U
Chrysene	U	U	U
Dibenzo(a,h)anthracene	U	U	U
Di-n-butylphthalate	U	U	U
1,2-Dichlorobenzene	U	U	U
1,3-Dichlorobenzene	U	U	U
1,4-Dichlorobenzene	U	U	U
3,3'-Dichlorobenzidene	U	U	U
Diethylphthalate	U	U	U
Dimethylphthalate	U	U	U
2,4-Dinitrotoluene	U	U	U
2,6-Dinitrotoluene	U	U	U
Di-n-Octylphthalate	U	U	U
1,2-Diphenylhydrazine	U	U	U
Fluoranthene	U	U	U
Fluorene	U	U	U
Hexachlorobenzene	U	U	U
Hexachlorobutadiene	U	U	U
Hexachloroethane	U	U	U
Hexachlorocyclopentadiene	U	U	U
Indeno(123-cd)pyrene	U	U	U
Isophorone	U	U	U
Naphthalene	U	U	U

BAYWAY REFINERY
EFFLUENT CHARACTERIZATION
NJPDES PERMIT NO. NJ0001511

	RRAv-Ditch 5/26/93	RRAv-Ditch 6/23/93	194 Sphere 6/10/93
Nitrobenzene	U	U	U
N-Nitoso-dimethylamine	U	U	U
N-Nitrosodi-n-propylamine	U	U	U
N-Nitrosodiphenylamine	U	U	U
Phenanthrene	U	U	U
Pyrene	U	U	U
1,2,4-Trichlorobenzene	U	U	U
4-Chloro-3-methylphenol	U	U	U
2-Chlorophenol	U	U	U
2,4-Dichlorophenol	U	U	U
2,4-Dimethylphenol	U	U	U
2,4-Dinitrophenol	U	U	U
4,6-Dinitro-2-methylphenol	U	U	U
2-Nitrophenol	U	U	U
4-Nitrophenol	U	U	U
Pentachlorophenol	U	U	U
Phenol	U	U	U
2,4,6-Trichlorophenol	U	U	U
Volatile Organics, ug/L			
Acrolein	U	U	U
Acrylonitrile	U	U	U
Benzene	U	U	8
Bromoform	U	12	U
Bromomethane	U	U	U
Carbon Tetrachloride	U	U	U
Chlorobenzene	U	U	U
Chlorodibromobenzene	U	U	U
Chloroethane	U	U	U
2-Chloroethylvinyl Ether	U	U	U
Chloroform	U	U	U
Chloromethane	U	U	U
Dichlorobromomethane	U	U	U
1,1-Dichloroethane	U	U	U
1,2-Dichloroethane	U	U	U
1,1-Dichloroethene	U	U	U
trans-1,2-Dichloroethene	U	U	U
1,2-Dichloropropane	U	U	U
cis-1,3-Dichloropropene	U	U	U
trans-1,3-Dichloropropene	U	U	U

BAYWAY REFINERY
EFFLUENT CHARACTERIZATION
NJPDES PERMIT NO. NJ0001511

	RRAv-Ditch 5/26/93	RRAv-Ditch 6/23/93	194 Sphere 6/10/93
Ethylbenzene	U	U	U
Methylene Chloride	U	3 J	11
1,1,2,2-Tetrachloroethane	U	U	U
Tetrachloroethene	U	U	U
Toluene	U	U	4 J
1,1,1-Trichloroethane	U	U	U
1,1,2-Trichloroethane	U	U	U
Trichloroethene	U	U	U
Trichlorofluoromethane	U	U	@
Vinyl Chloride	U	U	U
Parameter, mg/L			
Ammonia-N	0.26	0.633	0.51
BOD5	ND	BMDL	BMDL
COD	110	108	1600
TPHC	ND	1.14	3.6
Total Phenols	0.038	0.036	0.01
Sulfide	0.04	BMDL	BMDL
TSS	24	14	31
Temperature, deg. C	24.6	28.6	N/A

ATTACHMENT 2

Chronic Toxicity Characterization Study
Bayway Refinery
NJPDES Permit No. NJ0001511
DSN 002

Date of Test: 6/25/93 to 7/2/93

Species	Lab	Effluent Toxicity NOEC	Effluent Toxicity LOEC
Sheepshead Minnow (Cyprinodon variegatus)	IT	100%	> 100%
Inland Silverside (Menidia beryllina)	PTL	50%	100%
Mysid Shrimp (Mysidopsis bahia)	IT	100%	> 100%
Mysid Shrimp (Mysidopsis bahia)	PTL	100%	> 100%

NOEC = No Observable Effect Concentration

LOEC = Lowest Observable Effect Concentration

IT = IT, Corp., Edison, N.J.

PTL = Princeton Testing Laboratory, Princeton, N.J.

ATTACHMENT 3

BAYWAY REFINERY
EFFLUENT CHARACTERIZATION
NJPDES PERMIT NO. NJ0001511

Rainfall log

Date	Rainfall (In.)	Duration (Hrs.)	Notes
5/1/93	0	0	
5/2/93	0	0	
5/3/93	0	0	
5/4/93	0	0	
5/5/93	0.26	4	< -50% Of avg.
5/6/93	0	0	
5/7/93	0	0	
5/8/93	0	0	
5/9/93	0	0	
5/10/93	0	0	
5/11/93	0.1	0.5	Brief T-Storm, Heavy rain, short duration
5/12/93	0	0	
5/13/93	0.01	2	Light rain
5/14/93	0	0	
5/15/93	0	0	
5/16/93	0.1	2	Sunday, < -50% of avg.
5/17/93	0	0	
5/18/93	0.1	4	Light rain, no discharges, <72 hrs. dry
5/19/93	0.18	?	Night, <72 hrs. dry
5/20/93	0.03	0.5	
5/21/93	0	0	
5/22/93	0.01	0.5	
5/23/93	0	0	
5/24/93	0	0	
5/25/93	0	0	
5/26/93	0	0	
5/27/93	0	0	
5/28/93	0	0	
5/29/93	0	0	
5/30/93	0	0	
5/31/93	1.24	5	Heavy rain, night, > +50% of avg.

	Duration	Volume
Representative Rainfall, +/- 50% of Avg. =	5.6-16.7 hrs.	0.31-0.92 in.

ATTACHMENT 3

BAYWAY REFINERY
EFFLUENT CHARACTERIZATION
NJPDES PERMIT NO. NJ0001511

Rainfall log

Date	Rainfall (In.)	Duration (Hrs.)	Notes
6/1/93	0	0	
6/2/93	0	0	
6/3/93	0	0	
6/4/93	0.04	0	
6/5/93	0.13	3	Saturday, < -50% of avg.
6/6/93	0	0	
6/7/93	0	0	
6/8/93	0.15	2	<72 hrs. dry, < -50% of avg.
6/9/93	0.34	1	<72 hrs. dry, 2 short severe T-storms
6/10/93	0	0	
6/11/93	0	0	
6/12/93	0	0	
6/13/93	0	0	
6/14/93	0	0	
6/15/93	0	0	
6/16/93	0	0	
6/17/93	0	0	
6/18/93	0	0	
6/19/93	0	0	
6/20/93	0.52	?	Late night, started at 2230
6/21/93	0	0	
6/22/93	0	0	
6/23/93	0	0	
6/24/93	0	0	
6/25/93	0	0	
6/26/93	0.09	1	
6/27/93	0	0	
6/28/93	0	0	

ATTACHMENT 3

BAYWAY REFINERY
EFFLUENT CHARACTERIZATION
NJPDES PERMIT NO. NJ0001511

Rainfall log

Date	Rainfall (In.)	Duration (Hrs.)	Notes
6/29/93	0	0	
6/30/93	0	0	
7/1/93	0	0	
7/2/93	0.82	4	Started 2200,
7/3/93	0.43		Continuous from 7/2, > +50% of avg.
7/4/93	0	0	
7/5/93	0	0	
7/6/93	0	0	
7/7/93	0	0	
7/8/93	0	0	
7/9/93	0	0	
7/10/93	0	0	
7/11/93	0	0	
7/12/93	0	0	
7/13/93	0	0	
7/14/93	0.38	4	Severe T-storm 1500, 0.29 in., 20 min.
7/15/93	0	0	Additional light rain 2100, 0.09 in.
7/16/93			
7/17/93			
7/18/93			
7/19/93			
7/20/93			
7/21/93			
7/22/93			
7/23/93			
7/24/93			
7/25/93			
7/26/93			
7/27/93			
7/28/93			

Bayway Refining Company
a subsidiary of Tosco Corporation
1400 Park Avenue
Linden, New Jersey 07036

Thomas J. Nimbley
Vice President and
Refinery Manager

Certified Mail - RR
P 269 083 050
January 28, 1994

Quarterly Progress Report
NJPDES-DSW Permit No. NJ 0001511

Mr. Ben Manhas
New Jersey Department of Environmental Protection and Energy
Wastewater Facilities Regulation Program
Bureau of Standard Permitting
CN 029
Trenton, N.J. 08625-0029

Dear Mr. Manhas,

This is the Quarterly Progress Report on the status of work conducted, as required by NJPDES-DSW Permit No. NJ0001511, Part IV-Characterization, Paragraph 2D. This report covers the period 11/1/93 to 1/31/94.

Monthly effluent characterization sampling for the three once through cooling water discharges into Morses Creek designated #2 Dam, Poly Ditch and R.R. Ave. Ditch has been completed. The results for October, November and December are reported in Attachment 1. Also included are results from the purging of hydrotest water from two butane spheres. This is in accordance with a sampling plan for these discharges submitted June 22, 1993. Sampling for January has been completed and will be reported in the next quarterly report.

Chronic Toxicity Characterization Study testing was completed for the 3rd quarter of the permit year. Results for the tests conducted 12/8/93 to 12/15/93 are summarized in Attachment 2.

Monthly sampling of the stormwater discharges to Morses Creek has been completed for November, and 2 of the 3 discharges have been sampled for January. The results for October, which were not reported in the previous quarterly report, and November are listed in Attachment 3. January results will be reported in the next quarterly report. Stormwater samples for December were not obtained. There was 1 qualifying rainstorm, i.e. >0.1 inches of rain preceded by 72 hours of dry weather, and not varying by more than 50% from the annual average rainfall volume and duration. This event began at Approximately 8 pm on 12/10. The discharge points were monitored until approximately 11 pm, and there was insufficient rainfall at that point to generate run-off. Monitoring was discontinued at 11 pm.

Sampling for the update of the Impingement & Entrainment Demonstration under Section 316(b) of the Clean Water Act, as required in Part IV-B/C, Paragraph 7 was initiated in December and will continue through November 1994, as outlined in the Plan of Study submitted under separate cover dated Dec. 20, 1993.

A contract has been signed with IT Corporation, Edison, N.J. for the Section 316(a) demonstration also required by the above sited paragraph of the permit. Computer modeling development has been initiated, field sampling will take place in March and July, 1994.

Although a formal notification has not been received from the Department, the Dilution Study allowed under Part IV- Characterization, Paragraph 2C has been initiated.

This report is certified pursuant to N.J.A.C. 7:14A-2.4, and the certification is made subject to the statutory provisions of the N.J.S.A. 2C:28-3[a]. I certify, under penalty of law that I have personally examined and am familiar with the information submitted in this and all attached documents, and that the attached documents were prepared by personnel under my direct supervision in accordance with a system designed to assure that qualified personnel properly gather and evaluate the information submitted. Based on my inquiry of those individuals immediately responsible for obtaining the information, I believe that the submitted information is true, accurate, and complete. I am aware that there are significant civil and criminal penalties for submitting false, inaccurate or incomplete information, including the possibility of fine and/or imprisonment. Law JMB

Please contact Richard Klawunn at (908) 523-6089 if you have any questions or require further information.

Very truly yours,

Thomas J. Nimbley
T.J. Nimbley
Vice President & Refinery Manager

Attachments

Sworn & subscribed to before me this 28th day of January, 1994
Debra P. Rice

DEBRA P. RICE
NOTARY PUBLIC OF NEW JERSEY
My Commission Expires Jan. 8, 1995

BAYWAY REFINERY
EFFLUENT CHARACTERIZATION
NJPDES PERMIT NO. NJ0001511

QUALIFIERS

U - Indicates that the compound was analyzed for but not detected.

J - Indicates that the compound was analyzed for and determined to be present in the sample. The mass spectrum of the compound meets the identification criteria of the method. The concentration listed is an estimated value which is less than the specified minimum detection limit but is greater than zero.

B - This flag is used when the analyte is found in the blanks as well as the sample. It indicates possible contamination and warns the data user to use caution when applying the results of this analyte.

ND - Not detected.

BMDL - Below Method Detection Limit, the value below which the parameter cannot be accurately quantified.

'@ - Parameter was not analyzed for.

N/A - Not applicable to this sample.

ATTACHMENT 1

BAYWAY REFINERY
EFFLUENT CHARACTERIZATION
NJPDES PERMIT NO. NJ0001511

	#2 DAM 10/11/93	#2 DAM 11/8/93	#2 DAM 12/6/93
Pesticides, ug/L			
Aldrin	U	U	U
Alpha-BHC	U	0.025	U
Beta-BHC	U	0.12	U
Gamma-BHC	U	U	U
Delta-BHC	U	U	U
4,4'-DDT	U	U	U
4,4'-DDE	U	U	U
4,4'-DDD	U	U	U
Dieldrin	U	U	U
Endosulfan I	U	U	U
Endosulfan II	U	U	U
Endosulfan Sulfate	U	U	U
Endrin	U	U	U
Endrin Aldehyde	U	U	U
Heptachlor	U	U	U
Heptachlor Epoxide	U	U	U
PCB's	U	U	U
Toxaphene	U	U	U
Metals, ug/L			
Antimony	BMDL	BMDL	BMDL
Arsenic	BMDL	BMDL	BMDL
Beryllium	BMDL	BMDL	BMDL
Cadmium	BMDL	BMDL	BMDL
Chromium	BMDL	BMDL	BMDL
Chromium +6	BMDL	BMDL	BMDL
Copper	BMDL	BMDL	BMDL
Lead	BMDL	BMDL	BMDL
Mercury	BMDL	BMDL	BMDL
Nickel	BMDL	57	BMDL
Selenium	BMDL	BMDL	BMDL
Silver	BMDL	BMDL	BMDL
Thallium	BMDL	BMDL	BMDL
Zinc	39	45	33

ATTACHMENT 1

BAYWAY REFINERY
EFFLUENT CHARACTERIZATION
NJPDES PERMIT NO. NJ0001511

	#2 DAM 10/11/93	#2 DAM 11/8/93	#2 DAM 12/6/93
Acid/Base Neutrals, ug/L			
Acenaphthene	U	U	U
Acenaphthylene	U	U	U
Anthracene	U	U	U
Benzidene	U	U	U
Benzo(a)Anthracene	U	U	U
Benzo(b)Fluoranthene	U	U	U
Benzo(k)Fluoranthene	U	U	U
Benzo(a)Pyrene	U	U	U
Benzo(g,h,i)Perylene	U	U	U
bis(2-Chloroethyl)Ether	U	U	U
bis(2-Chloroethoxy)Methane	U	U	U
bis(2-Ethylhexyl)Phthalate	30	13	23
bis(2-Chloroisopropyl)Ether	U	U	U
4-Bromophenyl Phenyl Ether	U	U	U
Butyl Benzyl Phthalate	U	U	U
2-Chloronaphthalene	U	U	U
4-Chlorophenyl Phenyl Ether	U	U	U
Chrysene	U	U	U
Dibenzo(a,h)Anthracene	U	U	U
Di-n-butyl Phthalate	U	U	U
1,2-Dichlorobenzene	U	U	U
1,3-Dichlorobenzene	U	U	U
1,4-Dichlorobenzene	U	U	U
3,3'-Dichlorbenzidene	U	U	U
Diethylphthalate	U	U	U
Dimethylphthalate	U	U	U
2,4-Dinitrotoluene	U	U	U
2,6-Dinitrotoluene	U	U	U
Di-n-Octylphthalate	U	U	U
1,2-Diphenylhydrazine	U	U	U
Fluoranthene	U	U	U
Fluorene	U	U	2
Hexachlorobenzene	U	U	U
Hexachlorobutadiene	U	U	U
Hexachloroethane	U	U	U
Hexachlorocyclopentadiene	U	U	U
Indeno(1,2,3-cd)pyrene	U	U	U
Isophorone	U	U	U
Naphthalene	8	U	U
Nitrobenzene	U	U	U
N-Nitroso-Dimethylamine	U	U	U
N-Nitroso-di-n-propylamine	U	U	U

ATTACHMENT 1

BAYWAY REFINERY
EFFLUENT CHARACTERIZATION
NJPDES PERMIT NO. NJ0001511

	#2 DAM 10/11/93	#2 DAM 11/8/93	#2 DAM 12/6/93
N-Nitroso-diphenylamine	U	U	U
Phenanthrene	U	U	1
Pyrene	U	U	U
1,2,4-Trichlorobenzene	U	U	U
4-Chloro-m-Cresol	U	U	U
2-Chlorophenol	U	U	U
2,4-Dichlorophenol	U	U	U
2,4-Dimethylphenol	U	U	U
2,4-Dinitrophenol	U	U	U
4,6-Dinitro-o-Cresol	U	U	U
2-Nitrophenol	U	U	U
4-Nitrophenol	U	U	U
Pentachlorophenol	U	U	U
Phenol	U	U	U
2,4,6-Trichlorophenol	U	U	U
Other Parameters, mg/L			
Ammonia-N	0.640	0.682	0.646
BOD5	2.5	BMDL	BMDL
COD	BMDL	57.6	99
TPHC	BMDL	BMDL	BMDL
Phenols	0.057	0.015	0.029
Sulfides	BMDL	BMDL	BMDL
TSS	22.2	29	43
Temperature, deg. C	26.2	20	14.3
TOC	4.09	BMDL	BMDL

ATTACHMENT 1

BAYWAY REFINERY
EFFLUENT CHARACTERIZATION
NJPDES PERMIT NO. NJ0001511

Volatile Organics, ug/L	#2 DAM 10/11/93	#2 DAM 11/8/93	#2 DAM 12/6/93
Acrolein	U	U	U
Acrylonitrile	U	U	U
Benzene	35	19	21
Bromoform	120	U	U
Bromomethane	U	U	U
Carbon Tetrachloride	U	U	U
Chlorobenzene	U	U	U
Chlorodibromomethane	U	U	U
Chloroethane	U	U	U
2-Chloroethylvinyl Ether	U	U	U
Chloroform	U	U	U
Chloromethane	U	U	U
Dichlorobromomethane	U	U	U
1,1-Dichloroethane	U	U	U
1,2-Dichloroethane	U	U	U
1,1-Dichloroethene	U	U	U
1,2-Dichloroethene	U	U	U
1,2-Dichloropropane	U	U	U
cis-1,3-Dichloropropene	U	U	U
trans-1,3-Dichloropropene	U	U	U
Ethylbenzene	20	14	12
Methylene Chloride	2 JB	U	U
1,1,2,2-Tetrachloroethane	U	U	U
Tetrachloroethene	U	U	U
Toluene	63 B	52	59
1,1,1-Trichloroethane	U	U	U
1,1,2-Trichloroethane	U	U	U
Trichloroethene	U	U	U
Trichlorofluoromethane	U	U	U
Vinyl Chloride	U	U	U

ATTACHMENT 1

BAYWAY REFINERY
EFFLUENT CHARACTERIZATION
NJPDES PERMIT NO. NJ0001511

	Poly-Ditch 10/11/93	Poly-Ditch 11/8/93	Poly-Ditch 12/6/93
Pesticides, ug/L			
Aldrin	U	U	U
Alpha-BHC	U	U	U
Beta-BHC	U	U	U
Gamma-BHC	U	U	U
Delta-BHC	U	U	U
4,4'-DDT	U	U	U
4,4'-DDE	U	U	U
4,4'-DDD	U	U	U
Dieldrin	U	U	U
Endosulfan I	U	U	U
Endosulfan II	U	U	U
Endosulfan Sulfate	U	U	U
Endrin	U	U	U
Endrin Aldehyde	U	U	U
Heptachlor	U	U	U
Heptachlor Epoxide	U	U	U
PCB's	U	U	U
Toxaphene	U	U	U
Metals, ug/L			
Antimony	BMDL	BMDL	BMDL
Arsenic	BMDL	BMDL	BMDL
Beryllium	BMDL	BMDL	BMDL
Cadmium	BMDL	BMDL	BMDL
Chromium	BMDL	BMDL	BMDL
Chromium +6	BMDL	BMDL	BMDL
Copper	BMDL	BMDL	BMDL
Lead	BMDL	BMDL	BMDL
Mercury	BMDL	BMDL	BMDL
Nickel	BMDL	BMDL	BMDL
Selenium	BMDL	BMDL	BMDL
Silver	BMDL	BMDL	BMDL
Thallium	BMDL	BMDL	BMDL
Zinc	BMDL	74	38

ATTACHMENT 1

BAYWAY REFINERY
EFFLUENT CHARACTERIZATION
NJPDES PERMIT NO. NJ0001511

	Poly-Ditch 10/11/93	Poly-Ditch 11/8/93	Poly-Ditch 12/6/93
Acid/Base Neutrals, ug/L			
Acenaphthene	U	U	U
Acenaphthylene	U	U	U
Anthracene	U	U	U
Benzidene	U	U	U
Benzo(a)Anthracene	U	U	U
Benzo(b)Fluoranthene	U	U	U
Benzo(k)Fluoranthene	U	U	U
Benzo(a)Pyrene	U	U	U
Benzo(g,h,i)Perylene	U	U	U
bis(2-Chloroethyl)Ether	U	U	U
bis(2-Chloroethoxy)Methane	U	U	U
bis(2-Ethylhexyl)Phthalate	8	U	2
bis(2-Chloroisopropyl)Ether	U	U	U
4-Bromophenyl Phenyl Ether	U	U	U
Butyl Benzyl Phthalate	U	U	U
2-Chloronaphthalene	U	U	U
4-Chlorophenyl Phenyl Ether	U	U	U
Chrysene	U	U	U
Dibenzo(a,h)Anthracene	U	U	U
Di-n-butyl Phthalate	U	U	U
1,2-Dichlorobenzene	U	U	U
1,3-Dichlorobenzene	U	U	U
1,4-Dichlorobenzene	U	U	U
3,3'-Dichlorbenzidene	U	U	U
Diethylphthalate	U	U	U
Dimethylphthalate	U	U	U
2,4-Dinitrotoluene	U	U	U
2,6-Dinitrotoluene	U	U	U
Di-n-Octylphthalate	U	U	U
1,2-Diphenylhydrazine	U	U	U
Fluoranthene	U	U	U
Fluorene	U	U	U
Hexachlorobenzene	U	U	U
Hexachlorobutadiene	U	U	U
Hexachloroethane	U	U	U
Hexachlorocyclopentadiene	U	U	U
Indeno(1,2,3-cd)pyrene	U	U	U
Isophorone	U	U	U
Naphthalene	U	U	U
Nitrobenzene	U	U	U
N-Nitroso-Dimethylamine	U	U	U
N-Nitroso-di-n-propylamine	U	U	U

ATTACHMENT 1

BAYWAY REFINERY
EFFLUENT CHARACTERIZATION
NJPDES PERMIT NO. NJ0001511

	Poly-Ditch **10/11/93**	**Poly-Ditch** **11/8/93**	**Poly-Ditch** **12/6/93**
N-Nitroso-diphenylamine	U	1 J	U
Phenanthrene	U	U	U
Pyrene	U	U	U
1,2,4-Trichlorobenzene	U	U	U
4-Chloro-m-Cresol	U	U	U
2-Chlorophenol	U	U	U
2,4-Dichlorophenol	U	U	U
2,4-Dimethylphenol	U	U	U
2,4-Dinitrophenol	U	U	U
4,6-Dinitro-o-Cresol	U	U	U
2-Nitrophenol	U	U	U
4-Nitrophenol	U	U	U
Pentachlorophenol	U	U	U
Phenol	U	U	U
2,4,6-Trichlorophenol	U	U	U
<u>Other Parameters, mg/L</u>			
Ammonia-N	0.778	0.714	0.676
BOD5	1.2	BMDL	BMDL
COD	176	BMDL	119
TPHC	BMDL	BMDL	BMDL
Phenols	0.009	BMDL	0.019
Sulfides	BMDL	BMDL	BMDL
TSS	10.1	16	50
Temperature, deg. C	20.6	14.4	11.1
TOC	9.18	BMDL	BMDL

ATTACHMENT 1

BAYWAY REFINERY
EFFLUENT CHARACTERIZATION
NJPDES PERMIT NO. NJ0001511

	Poly-Ditch 10/11/93	Poly-Ditch 11/8/93	Poly-Ditch 12/6/93
Volatile Organics, ug/L			
Acrolein	U	U	U
Acrylonitrile	U	U	U
Benzene	U	U	13
Bromoform	55	U	U
Bromomethane	U	U	U
Carbon Tetrachloride	U	U	U
Chlorobenzene	U	U	U
Chlorodibromomethane	U	U	U
Chloroethane	U	U	U
2-Chloroethylvinyl Ether	U	U	U
Chloroform	U	U	U
Chloromethane	U	U	U
Dichlorobromomethane	U	U	U
1,1-Dichloroethane	U	U	U
1,2-Dichloroethane	U	U	U
1,1-Dichloroethene	U	U	U
1,2-Dichloroethene	U	U	U
1,2-Dichloropropane	U	U	U
cis-1,3-Dichloropropene	U	U	U
trans-1,3-Dichloropropene	U	U	U
Ethylbenzene	U	U	U
Methylene Chloride	U	U	U
1,1,2,2-Tetrachloroethane	U	U	U
Tetrachloroethene	U	U	U
Toluene	U	U	7
1,1,1-Trichloroethane	U	U	U
1,1,2-Trichloroethane	U	U	U
Trichloroethene	U	U	U
Trichlorofluoromethane	U	U	U
Vinyl Chloride	U	U	U

BAYWAY REFINERY
EFFLUENT CHARACTERIZATION
NJPDES PERMIT NO. NJ0001511

	RRAv-Ditch 10/11/93	RRAv-Ditch 11/8/93	RRAv-Ditch 12/6/93	199 Sphere 10/1/93	195 Sphere 11/7/93
Aldrin	U	U	U	U	U
Alpha-BHC	U	U	U	U	U
Beta-BHC	U	U	U	U	U
Gamma-BHC	U	U	U	U	U
Delta-BHC	U	U	U	U	U
4,4'-DDT	U	U	U	U	U
4,4'-DDE	U	U	U	U	0.045 J
4,4'-DDD	U	U	U	U	U
Dieldrin	U	U	U	U	U
Endosulfan I	U	U	U	U	U
Endosulfan II	U	U	U	U	0.010 J
Endosulfan Sulfate	U	U	U	U	0.017 J
Endrin	U	U	U	U	0.022 J
Endrin Aldehyde	U	U	U	U	U
Heptachlor	U	U	U	U	U
Heptachlor Epoxide	U	U	U	U	U
PCB's	U	U	U	@	U
Toxaphene	U	U	U	U	U
Metals, ug/L					
Antimony	BMDL	BMDL	BMDL	ND	ND
Arsenic	BMDL	BMDL	BMDL	ND	ND
Beryllium	BMDL	BMDL	BMDL	ND	ND
Cadmium	BMDL	BMDL	BMDL	ND	ND
Chromium	BMDL	BMDL	BMDL	ND	ND
Chromium +6	BMDL	BMDL	BMDL	ND	ND
Copper	BMDL	BMDL	31	ND	ND
Lead	BMDL	BMDL	BMDL	ND	ND
Mercury	BMDL	BMDL	BMDL	ND	0.35
Nickel	BMDL	BMDL	BMDL	ND	64
Selenium	BMDL	BMDL	BMDL	ND	ND
Silver	BMDL	BMDL	BMDL	ND	ND
Thallium	BMDL	BMDL	BMDL	ND	ND
Zinc	BMDL	60	39	ND	ND

BAYWAY REFINERY
EFFLUENT CHARACTERIZATION
NJPDES PERMIT NO. NJ0001511

	RRAv-Ditch 10/11/93	RRAv-Ditch 11/8/93	RRAv-Ditch 12/6/93	199 Sphere 10/1/93	195 Sphere 11/7/93
Acid/Base Neutrals, ug/L					
Acenaphthene	U	U	U	U	U
Acenaphthylene	U	U	U	U	U
Anthracene	U	U	U	U	U
Benzidene	U	U	U	U	U
Benzo(a)Anthracene	U	U	U	U	U
Benzo(b)Fluoranthene	U	U	U	U	U
Benzo(k)Fluoranthene	U	U	U	U	U
Benzo(a)Pyrene	U	U	U	U	U
Benzo(g,h,i)Perylene	U	U	U	U	U
bis(2-Chloroethyl)Ether	U	U	U	U	U
bis(2-Chloroethoxy)Methane	U	U	U	U	U
bis(2-Ethylhexyl)Phthalate	30	17	19	U	22 B
bis(2-Chloroisopropyl)Ether	U	U	U	U	U
4-Bromophenyl Phenyl Ether	U	U	U	U	U
Butyl Benzyl Phthalate	U	U	U	U	U
2-Chloronaphthalene	U	U	U	U	U
4-Chlorophenyl Phenyl Ether	U	U	U	U	U
Chrysene	U	U	U	U	U
Dibenzo(a,h)Anthracene	U	U	U	U	U
Di-n-butyl Phthalate	U	U	U	U	U
1,2-Dichlorobenzene	U	U	U	U	U
1,3-Dichlorobenzene	U	U	U	U	U
1,4-Dichlorobenzene	U	U	U	U	U
3,3'-Dichlorbenzidene	U	U	U	U	U
Diethylphthalate	U	U	U	U	U
Dimethylphthalate	U	U	U	U	U
2,4-Dinitrotoluene	U	U	U	U	U
2,6-Dinitrotoluene	U	U	U	U	U
Di-n-Octylphthalate	U	U	U	U	U
1,2-Diphenylhydrazine	U	U	U	U	U
Fluoranthene	U	U	U	U	U
Fluorene	U	U	U	U	U
Hexachlorobenzene	U	U	U	U	U
Hexachlorobutadiene	U	U	U	U	U
Hexachloroethane	U	U	U	U	U
Hexachlorocyclopentadiene	U	U	U	U	U
Indeno(1,2,3-cd)pyrene	U	U	U	U	U
Isophorone	U	U	U	U	U
Naphthalene	U	U	U	U	U
Nitrobenzene	U	U	U	U	U
N-Nitroso-Dimethylamine	U	U	U	U	U
N-Nitroso-di-n-propylamine	U	U	U	U	U

ATTACHMENT 1

BAYWAY REFINERY
EFFLUENT CHARACTERIZATION
NJPDES PERMIT NO. NJ0001511

	RRAv-Ditch 10/11/93	RRAv-Ditch 11/8/93	RRAv-Ditch 12/6/93	199 Sphere 10/1/93	195 Sphere 11/7/93
N-Nitroso-diphenylamine	U	1 J	U	U	U
Phenanthrene	U	U	U	U	U
Pyrene	U	U	U	U	U
1,2,4-Trichlorobenzene	U	U	U	U	U
4-Chloro-m-Cresol	U	U	U	U	U
2-Chlorophenol	U	U	U	U	U
2,4-Dichlorophenol	U	U	U	U	U
2,4-Dimethylphenol	U	U	U	U	U
2,4-Dinitrophenol	U	U	U	U	U
4,6-Dinitro-o-Cresol	U	U	U	U	U
2-Nitrophenol	U	U	U	U	U
4-Nitrophenol	U	U	U	U	U
Pentachlorophenol	U	U	U	U	U
Phenol	U	U	U	U	U
2,4,6-Trichlorophenol	U	U	U	U	U
Other Parameters, mg/L					
Ammonia-N	0.573	0.573	0.603	0.200	0.380
BOD5	BMDL	BMDL	BMDL	13	60
COD	78.4	BMDL	59	170	36
TPHC	2.5	BMDL	BMDL	4.4	6.3
Phenols	0.019	0.013	0.017	0.011	0.017
Sulfides	BMDL	BMDL	BMDL	ND	ND
TSS	7.11	16	48	13	130
Temperature, deg. C	29	24	21.7	@	@
TOC	8.15	BMDL	BMDL	9	@

BAYWAY REFINERY
EFFLUENT CHARACTERIZATION
NJPDES PERMIT NO. NJ0001511

	RRAv-Ditch 10/11/93	RRAv-Ditch 11/8/93	RRAv-Ditch 12/6/93	199 Sphere 10/1/93	195 Sphere 11/7/93
Volatile Organics, ug/L					
Acrolein	U	U	U	U	U
Acrylonitrile	U	U	U	U	U
Benzene	U	U	U	U	50
Bromoform	66	U	U	12	U
Bromomethane	U	U	U	U	U
Carbon Tetrachloride	U	U	U	U	U
Chlorobenzene	U	U	U	U	U
Chlorodibromomethane	U	U	U	U	U
Chloroethane	U	U	U	U	U
2-Chloroethylvinyl Ether	U	U	U	U	U
Chloroform	U	U	U	U	U
Chloromethane	U	U	U	U	U
Dichlorobromomethane	U	U	U	U	U
1,1-Dichloroethane	U	U	U	U	U
1,2-Dichloroethane	U	U	U	U	U
1,1-Dichloroethene	U	U	U	U	U
1,2-Dichloroethene	U	U	U	U	U
1,2-Dichloropropane	U	U	U	U	U
cis-1,3-Dichloropropene	U	U	U	U	U
trans-1,3-Dichloropropene	U	U	U	U	U
Ethylbenzene	U	U	U	U	U
Methylene Chloride	2 JB	1 JB	U	U	U
1,1,2,2-Tetrachloroethane	U	U	U	U	U
Tetrachloroethene	U	U	U	U	U
Toluene	U	U	U	14	7
1,1,1-Trichloroethane	U	U	U	U	U
1,1,2-Trichloroethane	U	U	U	U	U
Trichloroethene	U	U	U	U	U
Trichlorofluoromethane	U	U	U	U	U
Vinyl Chloride	U	U	U	U	U

	Intake 11/7/93	Intake 11/8/93	Intake 11/9/93	Intake 12/5/93	Intake 12/6/93	Intake 12/7/93
Metals, ug/L						
Antimony	BMDL	BMDL	@	BMDL	BMDL	@
Arsenic	BMDL	BMDL	@	BMDL	BMDL	@
Beryllium	BMDL	BMDL	@	BMDL	BMDL	@
Cadmium	BMDL	BMDL	@	BMDL	BMDL	@
Chromium	BMDL	BMDL	@	BMDL	BMDL	@
Chromium +6	BMDL	BMDL	@	BMDL	BMDL	@
Copper	BMDL	BMDL	@	23	33	@
Lead	BMDL	BMDL	@	BMDL	BMDL	@
Mercury	BMDL	BMDL	@	BMDL	BMDL	@
Nickel	68	BMDL	@	BMDL	BMDL	@
Selenium	BMDL	BMDL	@	BMDL	BMDL	@
Silver	BMDL	BMDL	@	BMDL	BMDL	@
Thallium	BMDL	BMDL	@	BMDL	BMDL	@
Zinc	47	BMDL	@	BMDL	21	@

	Intake 11/7/93	Intake 11/8/93	Intake 11/9/93	Intake 12/5/93	Intake 12/6/93	Intake 12/7/93
Acid/Base Neutrals, ug/L						
Acenaphthene	U	U	@	U	U	@
Acenaphthylene	U	U	@	U	U	@
Anthracene	U	U	@	U	U	@
Benzidene	U	U	@	U	U	@
Benzo(a)Anthracene	U	U	@	U	U	@
Benzo(b)Fluoranthene	U	U	@	U	U	@
Benzo(k)Fluoranthene	U	U	@	U	U	@
Benzo(a)Pyrene	U	U	@	U	U	@
Benzo(g,h,i)Perylene	U	U	@	U	U	@
bis(2-Chloroethyl)Ether	U	U	@	U	U	@
bis(2-Chloroethoxy)Methane	U	U	@	U	U	@
bis(2-Ethylhexyl)Phthalate	U	U	@	U	U	@
bis(2-Chloroisopropyl)Ether	U	U	@	U	U	@
4-Bromophenyl Phenyl Ether	U	U	@	U	U	@
Butyl Benzyl Phthalate	U	U	@	U	U	@
2-Chloronaphthalene	U	U	@	U	U	@
4-Chlorophenyl Phenyl Ether	U	U	@	U	U	@
Chrysene	U	U	@	U	U	@
Dibenzo(a,h)Anthracene	U	U	@	U	U	@
Di-n-butyl Phthalate	U	U	@	U	U	@
1,2-Dichlorobenzene	U	U	@	U	U	@
1,3-Dichlorobenzene	U	U	@	U	U	@
1,4-Dichlorobenzene	U	U	@	U	U	@
3,3'-Dichlorbenzidene	U	U	@	U	U	@
Diethylphthalate	U	U	@	U	U	@
Dimethylphthalate	U	U	@	U	U	@
2,4-Dinitrotoluene	U	U	@	U	U	@
2,6-Dinitrotoluene	U	U	@	U	U	@
Di-n-Octylphthalate	U	U	@	U	U	@
1,2-Diphenylhydrazine	U	U	@	U	U	@
Fluoranthene	U	U	@	U	U	@
Fluorene	U	U	@	U	U	@
Hexachlorobenzene	U	U	@	U	U	@
Hexachlorobutadiene	U	U	@	U	U	@
Hexachloroethane	U	U	@	U	U	@
Hexachlorocyclopentadiene	U	U	@	U	U	@
Indeno(1,2,3-cd)pyrene	U	U	@	U	U	@
Isophorone	U	U	@	U	U	@
Naphthalene	U	U	@	U	U	@
Nitrobenzene	U	U	@	U	U	@
N-Nitroso-Dimethylamine	U	U	@	U	U	@
N-Nitroso-di-n-propylamine	U	U	@	U	U	@

	Intake 11/7/93	Intake 11/8/93	Intake 11/9/93	Intake 12/5/93	Intake 12/6/93	Intake 12/7/93
N-Nitroso-diphenylamine	1 J	1 J	@	U	U	@
Phenanthrene	U	U	@	U	U	@
Pyrene	U	U	@	U	U	@
1,2,4-Trichlorobenzene	U	U	@	U	U	@
4-Chloro-m-Cresol	U	U	@	U	U	@
2-Chlorophenol	U	U	@	U	U	@
2,4-Dichlorophenol	U	U	@	U	U	@
2,4-Dimethylphenol	U	U	@	U	U	@
2,4-Dinitrophenol	U	U	@	U	U	@
4,6-Dinitro-o-Cresol	U	U	@	U	U	@
2-Nitrophenol	U	U	@	U	U	@
4-Nitrophenol	U	U	@	U	U	@
Pentachlorophenol	U	U	@	U	U	@
Phenol	U	U	@	U	U	@
2,4,6-Trichlorophenol	U	U	@	U	U	@
Other Parameters, mg/L						
Ammonia-N	@	0.578	@	BMDL	@	@
BOD5	@	BMDL	@	@	BMDL	@
COD	@	57.6	@	64.0	@	@
TPHC	@	@	BMDL	@	BMDL	BMDL
Phenols	@	BMDL	@	BMDL	@	@
Sulfides	@	BMDL	@	BMDL	@	@
TSS	@	13	@	@	34	@
Temperature, deg. C*	10.4	10.2	10.4	6.7	6	5.6
TOC	4.3	2	5	BMDL	@	@

* Intake temperatures are 24 hr. averages
  all discharge sample temperatures are grab samples

	Intake 11/7/93	Intake 11/8/93	Intake 11/9/93	Intake 12/5/93	Intake 12/6/93	Intake 12/7/93
Volatile Organics, ug/L						
Acrolein	@	U	U	@	U	U
Acrylonitrile	@	U	U	@	U	U
Benzene	@	U	U	@	U	U
Bromoform	@	U	U	@	U	U
Bromomethane	@	U	U	@	U	U
Carbon Tetrachloride	@	U	U	@	U	U
Chlorobenzene	@	U	U	@	U	U
Chlorodibromomethane	@	U	U	@	U	U
Chloroethane	@	U	U	@	U	U
2-Chloroethylvinyl Ether	@	U	U	@	U	U
Chloroform	@	U	U	@	U	U
Chloromethane	@	U	U	@	U	U
Dichlorobromomethane	@	U	U	@	U	U
1,1-Dichloroethane	@	U	U	@	U	U
1,2-Dichloroethane	@	U	U	@	U	U
1,1-Dichloroethene	@	U	U	@	U	U
1,2-Dichloroethene	@	U	U	@	U	U
1,2-Dichloropropane	@	U	U	@	U	U
cis-1,3-Dichloropropene	@	U	U	@	U	U
trans-1,3-Dichloropropene	@	U	U	@	U	U
Ethylbenzene	@	U	U	@	U	U
Methylene Chloride	@	1 JB	1 JB	@	1 J	U
1,1,2,2-Tetrachloroethane	@	U	U	@	U	U
Tetrachloroethene	@	U	U	@	U	U
Toluene	@	U	U	@	U	U
1,1,1-Trichloroethane	@	U	U	@	U	U
1,1,2-Trichloroethane	@	U	U	@	U	U
Trichloroethene	@	U	U	@	U	U
Trichlorofluoromethane	@	U	U	@	U	U
Vinyl Chloride	@	U	U	@	U	U

ATTACHMENT 2

Chronic Toxicity Characterization Study
Bayway Refinery
NJPDES Permit No. NJ0001511
DSN 002
Date of Test:12/08/93 to 12/15/93

Species	Lab	Effluent Toxicity NOEC	Effluent Toxicity LOEC
Sheepshead Minnow (Cyprinodon variegatus)	IT	50%	100%
Inland Siverside (Menidia beryllina)	PTL	100%	>100%
Mysid Shrimp (Mysidopsis bahia)	IT	<6.25%	6.25%
Mysid Shrimp (Mysidopsis bahia)	PTL	25%	50%

NOEC=No Observable Effect Concentration

LOEC=Lowest Observable Effect Concentration

IT=It Corp., Edison, N.J.

PTL=Princeton Testing Laboratory, Princeton, N.J.

PTL reported no mortality effects, growth effects evident to 50% concentration
IT reported mortality effect at 100% only, growth effects at all concentrations

ATTACHMENT 3

BAYWAY REFINERY
EFFLUENT CHARACTERIZATION
NJPDES PERMIT NO. NJ0001511

STORMWATER SAMPLING

Parameters, mg/L	S2 10/12/93	S2 11/5/93	S3 10/12/93	S3 11/5/93	S8 10/12/93	S8 11/5/93
Ammonia-N	0.22	(1)	0.24	ND	0.2	0.051
BOD5	ND	(1)	ND	10	14	11
COD	9.6	(1)	16	25	33	29
Chromium	ND	(1)	ND	ND	ND	ND
Chromium +6	ND	(1)	ND	ND	ND	ND
TPHC	ND	(1)	ND	ND	ND	ND
Phenols	0.023	(1)	0.017	0.018	0.055	0.034
Sulfides	ND	(1)	ND	ND	ND	ND
TSS	44	(1)	100	11	47	41
Temperature, deg. C	16.5	(1)	16.7	13.8	23.7	17.5

* No discharge at this point for this rain event.
(1) Water held in firebank, not discharged.

Bayway **R**efining **C**ompany
a subsidiary of Tosco Corporation
1400 Park Avenue
Linden, New Jersey 07036

Thomas J. Nimbley
Vice President and
Refinery Manager

Certified Mail - RR
P 290 139 495

April 28, 1994

Fourth Quarterly Progress Report
covering 2/1/94 to 4/31/94
NJPDES-DSW Permit No. NJ 0001511

Mr. Ben Manhas
New Jersey Department of Environmental Protection and Energy
Wastewater Facilities Regulation Program
Bureau of Standard Permitting
CN 029
Trenton, N.J. 08625-0029

Dear Mr. Manhas,

This is the Quarterly Progress Report on the status of work conducted, as required by NJPDES-DSW Permit No. NJ0001511, Part IV-Characterization, Paragraph 2D. This report covers the period 2/1/94 to 4/31/94.

Monthly effluent characterization sampling for the three once through cooling water discharges into Morses Creek designated #2 Dam, Poly Ditch and R.R. Ave. Ditch has been completed. The results for January, February and March are reported in Attachment 1. Sampling for April has been completed and will be reported in the final report.

Chronic Toxicity Characterization Study testing was completed for the 4th quarter of the permit year. Results for the tests conducted 4/6/94 to 4/13/94 are summarized in Attachment 2.

Monthly sampling of the stormwater discharges to Morses Creek was completed for 2 of the 3 discharges in January and February and for all discharges in March. The results are summarized in Attachment 3. The samples taken in these 3 months were of snowmelt run-off. The S2 discharge point did not have sufficient melting during warm periods in January and February to generate run-off. The snow and ice in this tankfield area did not melt sufficiently to produce run-off until March.

Sampling for the update of the Impingement & Entrainment Demonstration under Section 316(b) of the Clean Water Act, as required in Part IV-B/C, Paragraph 7 has been proceeding smoothly, except during infrequent periods when maintenance is being conducted on the screens. During these periods, samples could only be collected at two screen wash sample points, rather than the normal three sample points. This is not expected to affect the overall quality of the data being collected.

Field sampling for the Section 316(a) demonstration also required by the above cited paragraph of the permit took place on 4/17 as indicated by a notification of a tracer dye release to the Metro office by IT Corp., the contractor doing the work. Due to equipment problems with the dye pump and concerns over the effects of high winds in the late morning and early afternoon on the thermal plume, this sampling event will be repeated during the next neap tide in May. Additional field sampling will take place in July to collect data on extreme summer conditions.

This report is certified pursuant to N.J.A.C. 7:14A-2.4, and the certification is made subject to the statutory provisions of the N.J.S.A. 2C:28-3[a]. I certify, under penalty of law that I have personally examined and am familiar with the information submitted in this and all attached documents, and that the attached documents were prepared by personnel under my direct supervision in accordance with a system designed to assure that qualified personnel properly gather and evaluate the information submitted. Based on my inquiry of those individuals immediately responsible for obtaining the information, I believe that the submitted information is true, accurate, and complete. I am aware that there are significant civil and criminal penalties for submitting false, inaccurate or incomplete information, including the possibility of fine and/or imprisonment.

Please contact Richard Klawunn at (908) 523-6089 if you have any questions or require further information.

Very truly yours,

T. J. Nimbley

T.J. Nimbley
Vice President & Refinery Manager

Attachments

Mary Phillips
MARY PHILLIPS
NOTARY PUBLIC OF NEW JERSEY
My Commission Expires Oct. 20. 1998

BAYWAY REFINERY
EFFLUENT CHARACTERIZATION
NJPDES PERMIT NO. NJ0001511

QUALIFIERS

U - Indicates that the compound was analyzed for but not detected.

J - Indicates that the compound was analyzed for and determined to be present in the sample. The mass spectrum of the compound meets the identification criteria of the method. The concentration listed is an estimated value which is less than the specified minimum detection limit but is greater than zero.

B - This flag is used when the analyte is found in the blanks as well as the sample. It indicates possible contamination and warns the data user to use caution when applying the results of this analyte.

ND - Not detected.

BMDL - Below Method Detection Limit, the value below which the parameter cannot be accurately quantified.

'@ - Parameter was not analyzed for.

N/A - Not applicable to this sample.

ATTACHMENT 1

BAYWAY REFINERY
EFFLUENT CHARACTERIZATION
NJPDES PERMIT NO. NJ0001511

	#2 DAM 1/11/94	#2 DAM 2/7/94	#2 DAM 3/7/94
Pesticides, ug/L			
Aldrin	U	U	U
Alpha-BHC	U	U	U
Beta-BHC	U	0.08	U
Gamma-BHC	U	U	U
Delta-BHC	U	U	U
4,4'-DDT	U	U	U
4,4'-DDE	U	U	U
4,4'-DDD	U	U	U
Dieldrin	U	U	U
Endosulfan I	U	U	U
Endosulfan II	U	U	U
Endosulfan Sulfate	U	U	U
Endrin	U	U	U
Endrin Aldehyde	U	U	U
Heptachlor	U	U	U
Heptachlor Epoxide	U	U	U
PCB's	U	U	U
Toxaphene	U	U	U
Metals, ug/L			
Antimony	BMDL	BMDL	BMDL
Arsenic	BMDL	BMDL	BMDL
Beryllium	BMDL	BMDL	BMDL
Cadmium	BMDL	BMDL	BMDL
Chromium	BMDL	BMDL	BMDL
Chromium +6	BMDL	BMDL	BMDL
Copper	BMDL	BMDL	24
Lead	BMDL	BMDL	BMDL
Mercury	BMDL	BMDL	BMDL
Nickel	BMDL	BMDL	BMDL
Selenium	BMDL	BMDL	BMDL
Silver	BMDL	BMDL	BMDL
Thallium	BMDL	BMDL	BMDL
Zinc	30	25	41

ATTACHMENT 1

BAYWAY REFINERY
EFFLUENT CHARACTERIZATION
NJPDES PERMIT NO. NJ0001511

	#2 DAM 1/11/94	#2 DAM 2/7/94	#2 DAM 3/7/94
Acid/Base Neutrals, ug/L			
Acenaphthene	U	U	U
Acenaphthylene	U	U	U
Anthracene	U	U	U
Benzidene	U	U	U
Benzo(a)Anthracene	U	U	U
Benzo(b)Fluoranthene	U	U	U
Benzo(k)Fluoranthene	U	U	U
Benzo(a)Pyrene	U	U	U
Benzo(g,h,i)Perylene	U	U	U
bis(2-Chloroethyl)Ether	U	U	U
bis(2-Chloroethoxy)Methane	U	U	U
bis(2-Ethylhexyl)Phthalate	33	30	27
bis(2-Chloroisopropyl)Ether	U	U	U
4-Bromophenyl Phenyl Ether	U	U	U
Butyl Benzyl Phthalate	U	U	U
2-Chloronaphthalene	U	U	U
4-Chlorophenyl Phenyl Ether	U	U	U
Chrysene	U	U	U
Dibenzo(a,h)Anthracene	U	U	U
Di-n-butyl Phthalate	U	U	U
1,2-Dichlorobenzene	U	U	U
1,3-Dichlorobenzene	U	U	U
1,4-Dichlorobenzene	U	U	U
3,3'-Dichlorbenzidene	U	U	U
Diethylphthalate	U	U	U
Dimethylphthalate	U	U	U
2,4-Dinitrotoluene	U	U	U
2,6-Dinitrotoluene	U	U	U
Di-n-Octylphthalate	U	U	U
1,2-Diphenylhydrazine	U	U	U
Fluoranthene	U	5	U
Fluorene	U	U	U
Hexachlorobenzene	U	U	U
Hexachlorobutadiene	U	U	U
Hexachloroethane	U	U	U
Hexachlorocyclopentadiene	U	U	U
Indeno(1,2,3-cd)pyrene	U	U	U
Isophorone	U	U	U
Naphthalene	10	4	U
Nitrobenzene	U	U	U
N-Nitroso-Dimethylamine	U	U	U
N-Nitroso-di-n-propylamine	U	U	U

ATTACHMENT 1

BAYWAY REFINERY
EFFLUENT CHARACTERIZATION
NJPDES PERMIT NO. NJ0001511

	#2 DAM 1/11/94	#2 DAM 2/7/94	#2 DAM 3/7/94
N-Nitroso-diphenylamine	U	U	U
Phenanthrene	1	2	U
Pyrene	U	U	U
1,2,4-Trichlorobenzene	U	U	U
4-Chloro-m-Cresol	U	U	U
2-Chlorophenol	U	U	U
2,4-Dichlorophenol	U	U	U
2,4-Dimethylphenol	U	U	5
2,4-Dinitrophenol	U	U	U
4,6-Dinitro-o-Cresol	U	U	U
2-Nitrophenol	U	U	U
4-Nitrophenol	U	U	U
Pentachlorophenol	U	U	U
Phenol	U	U	U
2,4,6-Trichlorophenol	U	U	U
Other Parameters, mg/L			
Ammonia-N	0.774	0.760	0.843
BOD5	BMDL	2.51	2.32
COD	123	328	214
TPHC	BMDL	BMDL	BMDL
Phenols	0.014	BMDL	0.023
Sulfides	BMDL	BMDL	BMDL
TSS	46	12	22
Temperature, deg. C	9.5	16.7	18
TOC	2.8	1.2	5.3

ATTACHMENT 1

BAYWAY REFINERY
EFFLUENT CHARACTERIZATION
NJPDES PERMIT NO. NJ0001511

	#2 DAM 1/11/94	#2 DAM 2/7/94	#2 DAM 3/7/94
Volatile Organics, ug/L			
Acrolein	U	U	U
Acrylonitrile	U	U	U
Benzene	51	16	920
Bromoform	U	16	U
Bromomethane	U	U	U
Carbon Tetrachloride	U	U	U
Chlorobenzene	U	U	U
Chlorodibromomethane	U	U	U
Chloroethane	U	U	U
2-Chloroethylvinyl Ether	U	U	U
Chloroform	U	U	U
Chloromethane	U	U	U
Dichlorobromomethane	U	U	U
1,1-Dichloroethane	U	U	U
1,2-Dichloroethane	U	U	U
1,1-Dichloroethene	U	U	U
1,2-Dichloroethene	U	U	U
1,2-Dichloropropane	U	U	U
cis-1,3-Dichloropropene	U	U	U
trans-1,3-Dichloropropene	U	U	U
Ethylbenzene	67	10	46
Methylene Chloride	8 JB	2 JB	36 JB
1,1,2,2-Tetrachloroethane	U	U	U
Tetrachloroethene	U	U	U
Toluene	210	51	1800 B
1,1,1-Trichloroethane	U	U	U
1,1,2-Trichloroethane	U	U	U
Trichloroethene	U	U	U
Trichlorofluoromethane	U	U	U
Vinyl Chloride	U	U	U

ATTACHMENT 1

BAYWAY REFINERY
EFFLUENT CHARACTERIZATION
NJPDES PERMIT NO. NJ0001511

	Poly-Ditch 1/11/94	Poly-Ditch 2/7/94	Poly-Ditch 3/8/94
Pesticides, ug/L			
Aldrin	U	U	U
Alpha-BHC	U	U	U
Beta-BHC	U	U	U
Gamma-BHC	U	U	U
Delta-BHC	U	U	U
4,4'-DDT	U	U	U
4,4'-DDE	U	U	U
4,4'-DDD	U	U	U
Dieldrin	U	U	U
Endosulfan I	U	U	U
Endosulfan II	U	U	U
Endosulfan Sulfate	U	U	U
Endrin	U	U	U
Endrin Aldehyde	U	U	U
Heptachlor	U	U	U
Heptachlor Epoxide	U	U	U
PCB's	U	U	U
Toxaphene	U	U	U
Metals, ug/L			
Antimony	BMDL	BMDL	BMDL
Arsenic	BMDL	BMDL	BMDL
Beryllium	BMDL	BMDL	BMDL
Cadmium	BMDL	BMDL	BMDL
Chromium	BMDL	BMDL	BMDL
Chromium +6	BMDL	BMDL	BMDL
Copper	BMDL	BMDL	BMDL
Lead	BMDL	BMDL	BMDL
Mercury	BMDL	BMDL	BMDL
Nickel	BMDL	BMDL	BMDL
Selenium	BMDL	BMDL	BMDL
Silver	BMDL	BMDL	BMDL
Thallium	BMDL	BMDL	BMDL
Zinc	41	BMDL	65

ATTACHMENT 1

BAYWAY REFINERY
EFFLUENT CHARACTERIZATION
NJPDES PERMIT NO. NJ0001511

	Poly-Ditch 1/11/94	Poly-Ditch 2/7/94	Poly-Ditch 3/8/94
Acid/Base Neutrals, ug/L			
Acenaphthene	U	U	U
Acenaphthylene	U	U	U
Anthracene	U	U	U
Benzidene	U	U	U
Benzo(a)Anthracene	U	U	U
Benzo(b)Fluoranthene	U	U	U
Benzo(k)Fluoranthene	U	U	U
Benzo(a)Pyrene	U	U	U
Benzo(g,h,i)Perylene	U	U	U
bis(2-Chloroethyl)Ether	U	U	U
bis(2-Chloroethoxy)Methane	U	U	U
bis(2-Ethylhexyl)Phthalate	23	3	2
bis(2-Chloroisopropyl)Ether	U	U	U
4-Bromophenyl Phenyl Ether	U	U	U
Butyl Benzyl Phthalate	U	U	U
2-Chloronaphthalene	U	U	U
4-Chlorophenyl Phenyl Ether	U	U	U
Chrysene	U	U	U
Dibenzo(a,h)Anthracene	U	U	U
Di-n-butyl Phthalate	U	U	U
1,2-Dichlorobenzene	U	U	U
1,3-Dichlorobenzene	U	U	U
1,4-Dichlorobenzene	U	U	U
3,3'-Dichlorbenzidene	U	U	U
Diethylphthalate	U	U	U
Dimethylphthalate	U	U	U
2,4-Dinitrotoluene	U	U	U
2,6-Dinitrotoluene	U	U	U
Di-n-Octylphthalate	U	U	U
1,2-Diphenylhydrazine	U	U	U
Fluoranthene	U	U	U
Fluorene	U	U	U
Hexachlorobenzene	U	U	U
Hexachlorobutadiene	U	U	U
Hexachloroethane	U	U	U
Hexachlorocyclopentadiene	U	U	U
Indeno(1,2,3-cd)pyrene	U	U	U
Isophorone	U	U	U
Naphthalene	U	U	U
Nitrobenzene	U	U	U
N-Nitroso-Dimethylamine	U	U	U
N-Nitroso-di-n-propylamine	U	U	U

ATTACHMENT 1

BAYWAY REFINERY
EFFLUENT CHARACTERIZATION
NJPDES PERMIT NO. NJ0001511

	Poly-Ditch 1/11/94	Poly-Ditch 2/7/94	Poly-Ditch 3/8/94
N-Nitroso-diphenylamine	U	U	U
Phenanthrene	U	U	U
Pyrene	U	U	U
1,2,4-Trichlorobenzene	U	U	U
4-Chloro-m-Cresol	U	U	U
2-Chlorophenol	U	U	U
2,4-Dichlorophenol	U	U	U
2,4-Dimethylphenol	U	U	U
2,4-Dinitrophenol	U	U	U
4,6-Dinitro-o-Cresol	U	U	U
2-Nitrophenol	U	U	U
4-Nitrophenol	U	U	U
Pentachlorophenol	U	U	U
Phenol	U	U	U
2,4,6-Trichlorophenol	U	U	U
Other Parameters, mg/L			
Ammonia-N	0.729	0.8	0.867
BOD5	BMDL	1.68	2.88
COD	168	469	217
TPHC	BMDL	BMDL	BMDL
Phenols	BMDL	BMDL	BMDL
Sulfides	BMDL	BMDL	BMDL
TSS	46	16	14
Temperature, deg. C	4.8	12.8	11.9
TOC	1.9	2.4	6.3

ATTACHMENT 1

BAYWAY REFINERY
EFFLUENT CHARACTERIZATION
NJPDES PERMIT NO. NJ0001511

Volatile Organics, ug/L	Poly-Ditch 1/11/94	Poly-Ditch 2/7/94	Poly-Ditch 3/8/94
Acrolein	U	U	U
Acrylonitrile	U	U	U
Benzene	4	2	2
Bromoform	U	22	U
Bromomethane	U	U	U
Carbon Tetrachloride	U	U	U
Chlorobenzene	U	U	U
Chlorodibromomethane	U	2	U
Chloroethane	U	U	U
2-Chloroethylvinyl Ether	U	U	U
Chloroform	U	U	U
Chloromethane	U	U	U
Dichlorobromomethane	U	U	U
1,1-Dichloroethane	U	U	U
1,2-Dichloroethane	U	U	U
1,1-Dichloroethene	U	U	U
1,2-Dichloroethene	U	U	U
1,2-Dichloropropane	U	U	U
cis-1,3-Dichloropropene	U	U	U
trans-1,3-Dichloropropene	U	U	U
Ethylbenzene	2	U	U
Methylene Chloride	U	U	U
1,1,2,2-Tetrachloroethane	U	U	U
Tetrachloroethene	U	U	3
Toluene	6	3	4 B
1,1,1-Trichloroethane	U	U	U
1,1,2-Trichloroethane	U	U	U
Trichloroethene	U	U	U
Trichlorofluoromethane	U	U	U
Vinyl Chloride	U	U	U

ATTACHMENT 1

BAYWAY REFINERY
EFFLUENT CHARACTERIZATION
NJPDES PERMIT NO. NJ0001511

	RRAv-Ditch 1/11/94	RRAv-Ditch 2/7/94	RRAv-Ditch 3/7/94
Pesticides, ug/L			
Aldrin	U	U	U
Alpha-BHC	U	U	U
Beta-BHC	U	U	U
Gamma-BHC	U	U	U
Delta-BHC	U	U	U
4,4'-DDT	U	U	U
4,4'-DDE	U	U	U
4,4'-DDD	U	U	U
Dieldrin	U	U	U
Endosulfan I	U	U	U
Endosulfan II	U	U	U
Endosulfan Sulfate	U	U	U
Endrin	U	U	U
Endrin Aldehyde	U	U	U
Heptachlor	U	U	U
Heptachlor Epoxide	U	U	U
PCB's	U	U	U
Toxaphene	U	U	U
Metals, ug/L			
Antimony	BMDL	BMDL	BMDL
Arsenic	BMDL	BMDL	BMDL
Beryllium	BMDL	BMDL	BMDL
Cadmium	BMDL	BMDL	BMDL
Chromium	BMDL	BMDL	BMDL
Chromium +6	BMDL	BMDL	BMDL
Copper	BMDL	BMDL	46
Lead	BMDL	BMDL	BMDL
Mercury	BMDL	BMDL	BMDL
Nickel	BMDL	BMDL	BMDL
Selenium	BMDL	BMDL	BMDL
Silver	BMDL	BMDL	BMDL
Thallium	BMDL	BMDL	BMDL
Zinc	27	BMDL	47

ATTACHMENT 1

BAYWAY REFINERY
EFFLUENT CHARACTERIZATION
NJPDES PERMIT NO. NJ0001511

	RRAv-Ditch 1/11/94	RRAv-Ditch 2/7/94	RRAv-Ditch 3/7/94
Acid/Base Neutrals, ug/L			
Acenaphthene	U	U	U
Acenaphthylene	U	U	U
Anthracene	U	U	U
Benzidene	U	U	U
Benzo(a)Anthracene	U	U	U
Benzo(b)Fluoranthene	U	U	U
Benzo(k)Fluoranthene	U	U	U
Benzo(a)Pyrene	U	U	U
Benzo(g,h,i)Perylene	U	U	U
bis(2-Chloroethyl)Ether	U	U	U
bis(2-Chloroethoxy)Methane	U	U	U
bis(2-Ethylhexyl)Phthalate	13	21	22
bis(2-Chloroisopropyl)Ether	U	U	U
4-Bromophenyl Phenyl Ether	U	U	U
Butyl Benzyl Phthalate	U	U	U
2-Chloronaphthalene	U	U	U
4-Chlorophenyl Phenyl Ether	U	U	U
Chrysene	U	U	U
Dibenzo(a,h)Anthracene	U	U	U
Di-n-butyl Phthalate	U	U	U
1,2-Dichlorobenzene	U	U	U
1,3-Dichlorobenzene	U	U	U
1,4-Dichlorobenzene	U	U	U
3,3'-Dichlorbenzidene	U	U	U
Diethylphthalate	U	U	U
Dimethylphthalate	U	U	U
2,4-Dinitrotoluene	U	U	U
2,6-Dinitrotoluene	U	U	U
Di-n-Octylphthalate	U	U	U
1,2-Diphenylhydrazine	U	U	U
Fluoranthene	U	U	U
Fluorene	U	U	U
Hexachlorobenzene	U	U	U
Hexachlorobutadiene	U	U	U
Hexachloroethane	U	U	U
Hexachlorocyclopentadiene	U	U	U
Indeno(1,2,3-cd)pyrene	U	U	U
Isophorone	U	U	U
Naphthalene	U	U	U
Nitrobenzene	U	U	U
N-Nitroso-Dimethylamine	U	U	U
N-Nitroso-di-n-propylamine	U	U	U

ATTACHMENT 1

BAYWAY REFINERY
EFFLUENT CHARACTERIZATION
NJPDES PERMIT NO. NJ0001511

	RRAv-Ditch 1/11/94	RRAv-Ditch 2/7/94	RRAv-Ditch 3/7/94
N-Nitroso-diphenylamine	U	U	U
Phenanthrene	U	U	U
Pyrene	U	U	U
1,2,4-Trichlorobenzene	U	U	U
4-Chloro-m-Cresol	U	U	U
2-Chlorophenol	U	U	U
2,4-Dichlorophenol	U	U	U
2,4-Dimethylphenol	U	U	U
2,4-Dinitrophenol	U	U	U
4,6-Dinitro-o-Cresol	U	U	U
2-Nitrophenol	U	U	U
4-Nitrophenol	U	U	U
Pentachlorophenol	U	U	U
Phenol	U	U	U
2,4,6-Trichlorophenol	U	U	U
Other Parameters, mg/L			
Ammonia-N	0.708	0.790	0.733
BOD5	BMDL	1.44	2.14
COD	17	648	276
TPHC	BMDL	BMDL	BMDL
Phenols	BMDL	BMDL	0.019
Sulfides	BMDL	BMDL	BMDL
TSS	31	21	32
Temperature, deg. C	16.8	24.2	20.2
TOC	1.8	1.6	4.9

ATTACHMENT 1

BAYWAY REFINERY
EFFLUENT CHARACTERIZATION
NJPDES PERMIT NO. NJ0001511

	RRAv-Ditch 1/11/94	RRAv-Ditch 2/7/94	RRAv-Ditch 3/7/94
Volatile Organics, ug/L			
Acrolein	U	U	U
Acrylonitrile	U	U	U
Benzene	U	U	U
Bromoform	U	17	U
Bromomethane	U	U	U
Carbon Tetrachloride	U	U	U
Chlorobenzene	U	U	U
Chlorodibromomethane	U	U	U
Chloroethane	U	U	U
2-Chloroethylvinyl Ether	U	U	U
Chloroform	U	U	U
Chloromethane	U	U	U
Dichlorobromomethane	U	U	U
1,1-Dichloroethane	U	U	U
1,2-Dichloroethane	U	U	U
1,1-Dichloroethene	U	U	U
1,2-Dichloroethene	U	U	U
1,2-Dichloropropane	U	U	U
cis-1,3-Dichloropropene	U	U	U
trans-1,3-Dichloropropene	U	U	U
Ethylbenzene	U	U	U
Methylene Chloride	U	3 JB	U
1,1,2,2-Tetrachloroethane	U	U	U
Tetrachloroethene	U	U	2
Toluene	U	2	4 B
1,1,1-Trichloroethane	U	U	U
1,1,2-Trichloroethane	U	U	U
Trichloroethene	U	U	U
Trichlorofluoromethane	U	U	U
Vinyl Chloride	U	U	U

ATTACHMENT 1

BAYWAY REFINERY
EFFLUENT CHARACTERIZATION
NJPDES PERMIT NO. NJ0001511

	Intake 1/9/94	Intake 1/10/94	Intake 1/11/94	Intake 2/6/94	Intake 2/7/94	Intake 2/8/94
Pesticides, ug/L						
Aldrin	@	@	@	@	@	@
Alpha-BHC	@	@	@	@	@	@
Beta-BHC	@	@	@	@	@	@
Gamma-BHC	@	@	@	@	@	@
Delta-BHC	@	@	@	@	@	@
4,4'-DDT	@	@	@	@	@	@
4,4'-DDE	@	@	@	@	@	@
4,4'-DDD	@	@	@	@	@	@
Dieldrin	@	@	@	@	@	@
Endosulfan I	@	@	@	@	@	@
Endosulfan II	@	@	@	@	@	@
Endosulfan Sulfate	@	@	@	@	@	@
Endrin	@	@	@	@	@	@
Endrin Aldehyde	@	@	@	@	@	@
Heptachlor	@	@	@	@	@	@
Heptachlor Epoxide	@	@	@	@	@	@
PCB's	@	@	@	@	@	@
Toxaphene	@	@	@	@	@	@
Metals, ug/L						
Antimony	@	BMDL	@	BMDL	BMDL	@
Arsenic	@	BMDL	@	BMDL	BMDL	@
Beryllium	@	BMDL	@	BMDL	BMDL	@
Cadmium	@	BMDL	@	BMDL	BMDL	@
Chromium	@	BMDL	@	BMDL	BMDL	@
Chromium +6	@	BMDL	@	BMDL	BMDL	@
Copper	@	BMDL	@	BMDL	BMDL	@
Lead	@	BMDL	@	BMDL	BMDL	@
Mercury	@	BMDL	@	BMDL	BMDL	@
Nickel	@	BMDL	@	BMDL	BMDL	@
Selenium	@	BMDL	@	BMDL	BMDL	@
Silver	@	BMDL	@	BMDL	BMDL	@
Thallium	@	BMDL	@	BMDL	BMDL	@
Zinc	@	BMDL	@	BMDL	BMDL	@

ATTACHMENT 1

BAYWAY REFINERY
EFFLUENT CHARACTERIZATION
NJPDES PERMIT NO. NJ0001511

	Intake 1/9/94	Intake 1/10/94	Intake 1/11/94	Intake 2/6/94	Intake 2/7/94	Intake 2/8/94
Acid/Base Neutrals, ug/L						
Acenaphthene	U	U	@	U	@	@
Acenaphthylene	U	U	@	U	@	@
Anthracene	U	U	@	U	@	@
Benzidene	U	U	@	U	@	@
Benzo(a)Anthracene	U	U	@	U	@	@
Benzo(b)Fluoranthene	U	U	@	U	@	@
Benzo(k)Fluoranthene	U	U	@	U	@	@
Benzo(a)Pyrene	U	U	@	U	@	@
Benzo(g,h,i)Perylene	U	U	@	U	@	@
bis(2-Chloroethyl)Ether	U	U	@	U	@	@
bis(2-Chloroethoxy)Methane	U	U	@	U	@	@
bis(2-Ethylhexyl)Phthalate	2	U	@	U	@	@
bis(2-Chloroisopropyl)Ether	U	U	@	U	@	@
4-Bromophenyl Phenyl Ether	U	U	@	U	@	@
Butyl Benzyl Phthalate	U	U	@	U	@	@
2-Chloronaphthalene	U	U	@	U	@	@
4-Chlorophenyl Phenyl Ether	U	U	@	U	@	@
Chrysene	U	U	@	U	@	@
Dibenzo(a,h)Anthracene	U	U	@	U	@	@
Di-n-butyl Phthalate	U	U	@	U	@	@
1,2-Dichlorobenzene	U	U	@	U	@	@
1,3-Dichlorobenzene	U	U	@	U	@	@
1,4-Dichlorobenzene	U	U	@	U	@	@
3,3'-Dichlorbenzidene	U	U	@	U	@	@
Diethylphthalate	U	U	@	U	@	@
Dimethylphthalate	U	U	@	U	@	@
2,4-Dinitrotoluene	U	U	@	U	@	@
2,6-Dinitrotoluene	U	U	@	U	@	@
Di-n-Octylphthalate	U	U	@	U	@	@
1,2-Diphenylhydrazine	U	U	@	U	@	@
Fluoranthene	U	U	@	U	@	@
Fluorene	U	U	@	U	@	@
Hexachlorobenzene	U	U	@	U	@	@
Hexachlorobutadiene	U	U	@	U	@	@
Hexachloroethane	U	U	@	U	@	@
Hexachlorocyclopentadiene	U	U	@	U	@	@
Indeno(1,2,3-cd)pyrene	U	U	@	U	@	@
Isophorone	U	U	@	U	@	@
Naphthalene	U	U	@	U	@	@
Nitrobenzene	U	U	@	U	@	@
N-Nitroso-Dimethylamine	U	U	@	U	@	@
N-Nitroso-di-n-propylamine	U	U	@	U	@	@

ATTACHMENT 1

BAYWAY REFINERY
EFFLUENT CHARACTERIZATION
NJPDES PERMIT NO. NJ0001511

	Intake 1/9/94	Intake 1/10/94	Intake 1/11/94	Intake 2/6/94	Intake 2/7/94	Intake 2/8/94
N-Nitroso-diphenylamine	U	U	@	U	@	@
Phenanthrene	U	U	@	U	@	@
Pyrene	U	U	@	U	@	@
1,2,4-Trichlorobenzene	U	U	@	U	@	@
4-Chloro-m-Cresol	U	U	@	U	@	@
2-Chlorophenol	U	U	@	U	@	@
2,4-Dichlorophenol	U	U	@	U	@	@
2,4-Dimethylphenol	U	U	@	U	@	@
2,4-Dinitrophenol	U	U	@	U	@	@
4,6-Dinitro-o-Cresol	U	U	@	U	@	@
2-Nitrophenol	U	U	@	U	@	@
4-Nitrophenol	U	U	@	U	@	@
Pentachlorophenol	U	U	@	U	@	@
Phenol	U	U	@	U	@	@
2,4,6-Trichlorophenol	U	U	@	U	@	@
Other Parameters, mg/L						
Ammonia-N	BMDL	@	@	0.999	0.720	@
BOD5	@	BMDL	@	@	1.32	@
COD	180.0	@	@	547	531	@
TPHC	@	BMDL	BMDL	@	BMDL	BMDL
Phenols	0.012	@	@	BMDL	BMDL	@
Sulfides	@	BMDL	@	@	BMDL	@
TSS	@	41	@	@	14	@
Temperature, deg. C*	-0.3	-0.3	0.0	0.2	0.5	-0.2
TOC	0.8	@	@	0.4	0.7	@

* Intake temperatures are 24 hr. averages
all discharge sample temperatures are grab samples

ATTACHMENT 1

BAYWAY REFINERY
EFFLUENT CHARACTERIZATION
NJPDES PERMIT NO. NJ0001511

	Intake 1/9/94	Intake 1/10/94	Intake 1/11/94	Intake 2/6/94	Intake 2/7/94	Intake 2/8/94
Volatile Organics, ug/L						
Acrolein	@	U	U	@	U	U
Acrylonitrile	@	U	U	@	U	U
Benzene	@	U	U	@	U	U
Bromoform	@	U	U	@	U	U
Bromomethane	@	U	U	@	U	U
Carbon Tetrachloride	@	U	U	@	U	U
Chlorobenzene	@	U	U	@	U	U
Chlorodibromomethane	@	U	U	@	U	U
Chloroethane	@	U	U	@	U	U
2-Chloroethylvinyl Ether	@	U	U	@	U	U
Chloroform	@	U	U	@	U	U
Chloromethane	@	U	U	@	U	U
Dichlorobromomethane	@	U	U	@	U	U
1,1-Dichloroethane	@	U	U	@	U	U
1,2-Dichloroethane	@	U	U	@	U	U
1,1-Dichloroethene	@	U	U	@	U	U
1,2-Dichloroethene	@	U	U	@	U	U
1,2-Dichloropropane	@	U	U	@	U	U
cis-1,3-Dichloropropene	@	U	U	@	U	U
trans-1,3-Dichloropropene	@	U	U	@	U	U
Ethylbenzene	@	U	U	@	U	U
Methylene Chloride	@	U	U	@	1 JB	3 JB
1,1,2,2-Tetrachloroethane	@	U	U	@	U	U
Tetrachloroethene	@	U	U	@	U	U
Toluene	@	U	U	@	2	2
1,1,1-Trichloroethane	@	U	U	@	U	U
1,1,2-Trichloroethane	@	U	U	@	U	U
Trichloroethene	@	U	U	@	U	U
Trichlorofluoromethane	@	U	U	@	U	U
Vinyl Chloride	@	U	U	@	U	U

ATTACHMENT 1

BAYWAY REFINERY
EFFLUENT CHARACTERIZATION
NJPDES PERMIT NO. NJ0001511

	Intake 3/6/94	Intake 3/7/94	Intake 3/8/94
Pesticides, ug/L			
Aldrin	@	@	@
Alpha-BHC	@	@	@
Beta-BHC	@	@	@
Gamma-BHC	@	@	@
Delta-BHC	@	@	@
4,4'-DDT	@	@	@
4,4'-DDE	@	@	@
4,4'-DDD	@	@	@
Dieldrin	@	@	@
Endosulfan I	@	@	@
Endosulfan II	@	@	@
Endosulfan Sulfate	@	@	@
Endrin	@	@	@
Endrin Aldehyde	@	@	@
Heptachlor	@	@	@
Heptachlor Epoxide	@	@	@
PCB's	@	@	@
Toxaphene	@	@	@
Metals, ug/L			
Antimony	BMDL	BMDL	@
Arsenic	BMDL	BMDL	@
Beryllium	BMDL	BMDL	@
Cadmium	BMDL	BMDL	@
Chromium	BMDL	BMDL	@
Chromium +6	BMDL	BMDL	@
Copper	BMDL	33	@
Lead	BMDL	BMDL	@
Mercury	BMDL	BMDL	@
Nickel	BMDL	BMDL	@
Selenium	BMDL	BMDL	@
Silver	BMDL	BMDL	@
Thallium	BMDL	BMDL	@
Zinc	59	74	@

ATTACHMENT 1

BAYWAY REFINERY
EFFLUENT CHARACTERIZATION
NJPDES PERMIT NO. NJ0001511

Acid/Base Neutrals, ug/L	Intake 3/6/94	Intake 3/7/94	Intake 3/8/94
Acenaphthene	U	U	@
Acenaphthylene	U	U	@
Anthracene	U	U	@
Benzidene	U	U	@
Benzo(a)Anthracene	U	U	@
Benzo(b)Fluoranthene	U	U	@
Benzo(k)Fluoranthene	U	U	@
Benzo(a)Pyrene	U	U	@
Benzo(g,h,i)Perylene	U	U	@
bis(2-Chloroethyl)Ether	U	U	@
bis(2-Chloroethoxy)Methane	U	U	@
bis(2-Ethylhexyl)Phthalate	1	U	@
bis(2-Chloroisopropyl)Ether	U	U	@
4-Bromophenyl Phenyl Ether	U	U	@
Butyl Benzyl Phthalate	U	U	@
2-Chloronaphthalene	U	U	@
4-Chlorophenyl Phenyl Ether	U	U	@
Chrysene	U	U	@
Dibenzo(a,h)Anthracene	U	U	@
Di-n-butyl Phthalate	U	U	@
1,2-Dichlorobenzene	U	U	@
1,3-Dichlorobenzene	U	U	@
1,4-Dichlorobenzene	U	U	@
3,3'-Dichlorbenzidene	U	U	@
Diethylphthalate	U	U	@
Dimethylphthalate	U	U	@
2,4-Dinitrotoluene	U	U	@
2,6-Dinitrotoluene	U	U	@
Di-n-Octylphthalate	U	U	@
1,2-Diphenylhydrazine	U	U	@
Fluoranthene	U	U	@
Fluorene	U	U	@
Hexachlorobenzene	U	U	@
Hexachlorobutadiene	U	U	@
Hexachloroethane	U	U	@
Hexachlorocyclopentadiene	U	U	@
Indeno(1,2,3-cd)pyrene	U	U	@
Isophorone	U	U	@
Naphthalene	U	U	@
Nitrobenzene	U	U	@
N-Nitroso-Dimethylamine	U	U	@
N-Nitroso-di-n-propylamine	U	U	@

ATTACHMENT 1

BAYWAY REFINERY
EFFLUENT CHARACTERIZATION
NJPDES PERMIT NO. NJ0001511

	Intake 3/6/94	Intake 3/7/94	Intake 3/8/94
N-Nitroso-diphenylamine	U	U	@
Phenanthrene	U	U	@
Pyrene	U	U	@
1,2,4-Trichlorobenzene	U	U	@
4-Chloro-m-Cresol	U	U	@
2-Chlorophenol	U	U	@
2,4-Dichlorophenol	U	U	@
2,4-Dimethylphenol	U	U	@
2,4-Dinitrophenol	U	U	@
4,6-Dinitro-o-Cresol	U	U	@
2-Nitrophenol	U	U	@
4-Nitrophenol	U	U	@
Pentachlorophenol	U	U	@
Phenol	U	U	@
2,4,6-Trichlorophenol	U	U	@
<u>Other Parameters, mg/L</u>			
Ammonia-N	BMDL	@	@
BOD5	@	1.16	@
COD	85	@	@
TPHC	@	BMDL	BMDL
Phenols	BMDL	@	@
Sulfides	@	BMDL	@
TSS	@	8	@
Temperature, deg. C*	2.4	3.1	3.1
TOC	4.8	@	@

* Intake temperatures are 24 hr. averages
all discharge sample temperatures are grab samples

ATTACHMENT 1

BAYWAY REFINERY
EFFLUENT CHARACTERIZATION
NJPDES PERMIT NO. NJ0001511

Volatile Organics, ug/L	Intake 3/6/94	Intake 3/7/94	Intake 3/8/94
Acrolein	@	U	U
Acrylonitrile	@	U	U
Benzene	@	1 J	U
Bromoform	@	U	U
Bromomethane	@	U	U
Carbon Tetrachloride	@	U	U
Chlorobenzene	@	U	U
Chlorodibromomethane	@	U	U
Chloroethane	@	U	U
2-Chloroethylvinyl Ether	@	U	U
Chloroform	@	U	U
Chloromethane	@	U	U
Dichlorobromomethane	@	U	U
1,1-Dichloroethane	@	U	U
1,2-Dichloroethane	@	U	U
1,1-Dichloroethene	@	U	U
1,2-Dichloroethene	@	U	U
1,2-Dichloropropane	@	U	U
cis-1,3-Dichloropropene	@	U	U
trans-1,3-Dichloropropene	@	U	U
Ethylbenzene	@	U	U
Methylene Chloride	@	U	U
1,1,2,2-Tetrachloroethane	@	U	U
Tetrachloroethene	@	3	3
Toluene	@	3 B	3 B
1,1,1-Trichloroethane	@	U	U
1,1,2-Trichloroethane	@	U	U
Trichloroethene	@	U	U
Trichlorofluoromethane	@	U	U
Vinyl Chloride	@	U	U

ATTACHMENT 2

Chronic Toxicity Characterization Study
Bayway Refinery
NJPDES Permit No. NJ0001511
DSN 002

Date of Test:4/06/94 to 4/13/94

Species	Lab	Effluent Toxicity NOEC	Effluent Toxicity LOEC
Sheepshead Minnow (Cyprinodon variegatus)	IT	50%	100%
Inland Siverside (Menidia beryllina)	PTL	100%	>100%
Mysid Shrimp (Mysidopsis bahia)	IT	N/A	N/A
Mysid Shrimp (Mysidopsis bahia)	PTL	25%	50%

NOEC = No Observable Effect Concentration

LOEC = Lowest Observable Effect Concentration

IT = It Corp., Edison, N.J.

PTL = Princeton Testing Laboratory, Princeton, N.J.

Mysid Shrimp test being performed by IT, Corp. declared invalid due to high mortality in the Control sample.

ATTACHMENT 3

BAYWAY REFINERY
EFFLUENT CHARACTERIZATION
NJPDES PERMIT NO. NJ0001511

STORMWATER SAMPLING

Parameters, mg/L	S2 1/13/94	S2 2/17/94	S2 3/22/94	S3 (3) 1/25/94	S3 (3) 2/16/94	S3 (3) 3/4/94	S8 (3) 1/13/94	S8 (3) 2/15/94	S8 (3) 3/4/94
Ammonia-N	(2)	(2)	ND	1.2	0.045	0.26	ND	0.022	ND
BOD5	(2)	(2)	12	210	ND	7.6	10	4.2	7.6
COD	(2)	(2)	40	400	110	19	32	11	19
Chromium	(2)	(2)	ND	ND	ND	ND	34	ND	ND
Chromium +6	(2)	(2)	ND	ND	ND	ND	ND	ND	ND
TPHC	(2)	(2)	ND	1.7	ND	ND	1.8	ND	ND
Phenols	(2)	(2)	ND	0.014	ND	0.12	0.022	0.022	0.013
Sulfides	(2)	(2)	0.12	0.72	ND	ND	ND	ND	ND
TSS	(2)	(2)	12	12	53	19	220	5	10
Temperature, deg. C	(2)	(2)	6.7	3.7	2	2	7	8.7	5.2

(2)Precipitation as snow and ice, discharge pipe and valve frozen, did not thaw enough to allow discharge.
(3) Precipitation as samples were of snowmelt run-off.

CARLIN, MADDOCK, FAY & CERBONE, P.C.
30 Vreeland Road
P. O. Box 751
Florham Park, New Jersey 07932
(201) 377-3350
Attorneys for Plaintiff

WATERS, McPHERSON, McNEILL
300 Lighting Way
P. O. Box 1560
Secaucus, New Jersey 07096
(201) 8634400
Attorneys for Plaintiffs

UNITED STATES DISTRICT COURT
FOR THE DISTRICT OF NEW JERSEY

EXXON CORPORATION, a New Jersey corporation,	:	Civil Action No.
	:	COMPLAINT
Plaintiff,	:	
vs.		
STATE OF NEW JERSEY, NEW JERSEY DEPARTMENT OF ENVIRONMENTAL PROTECTION and JUDITH YASKIN, Commissioner of the Department of Environmental Protection,	:	
Defendants.	:	

Plaintiff, Exxon Corporation (hereinafter "Exxon"), a corporation of the State of New Jersey, by way of Complaint against the defendants herein, says:

ALLEGATION OF JURISDICTION

1. This action arises under the Constitution of the United States, Article 1, Section 10, Clause 1; the Fifth Amendment to

the Constitution of the United States; and the Fourteenth Amendment of the Constitution of the United States, Section 1.

FIRST COUNT

2. Plaintiff Exxon is a corporation of the State of New Jersey with a place of business at Park Avenue, in the City of Linden, County of Union and State of New Jersey.

3. Plaintiff Exxon, through a division, Exxon Company, U.S.A., operates a petroleum refinery known as the Bayway Refinery in the City of Linden.

4. Since the inception of the Bayway Refinery in 1909, Morses Creek, a small tidal inlet from the Arthur Kill, has been used for the return of water pumped in from the Arthur Kill to cool process equipment. Treated process water from Bayway's Waste Water Treatment Facility is also discharged into Morses Creek.

5. Plaintiff Exxon is the successor by merger in 1972 to the Standard Oil Company (New Jersey). In 1927, the State of New Jersey, for valuable consideration gave a riparian grant ("Grant") to the Standard Oil Company conveying to it and its successors the lands under tide-water lying within the bed of Morses Creek above Koehler Way Bridge. The Grant conveyed all of the rights of the State of New Jersey to the lands with the only restriction that the land be used only for structures under which the tide might ebb and flow.

6. Notwithstanding the restriction in the Grant, in 1938 the State of New Jersey acting through the State Water Policy Commission, formally approved the placement of Dam No. 1 and Dam

No. 2 on Morses Creek. Dam No. 2 had been previously constructed in 1922. Dam No. 1 was constructed at the behest of Government Inspectors for the control of possible oil spills.

7. In 1952, the reconstruction of Dam No. 2 was approved by the State of New Jersey acting through the Division of Water Policy and Supply.

8. In 1963, the relocation and reconstruction of Dam No. 1 was approved by the State of New Jersey, acting through the Division of Water Policy and Supply.

9. In December, 1974, the State of New Jersey acting through the NJDEP attempted by certification to have its regulations for Surface Water Quality Standards ("SWQS") applied to the control of Exxon's use of Morses Creek for the discharge of once through cooling and treated process water.

10. After the petition of Exxon for relaxation of the State's certification, the NJDEP in March, 1975, revised its SWQS for the Tidal Portion of Morses Creek to an TW-4A Industrial Use Classification so that Exxon could continue its use of the Creek.

11. In 1980, the NJDEP proposed the revision of the classification of Morses Creek from TW-4A Industrial Use to TW-3. The uses under the TW-3 classification would be contact recreation, the maintenance and migration of fish populations, the maintenance and migration of diadromous fish and the maintenance of wildlife. Imposition of effluent limitations on Exxon's discharge to achieve these uses would have required Exxon to cease its industrial use of Morses Creek.

12. After the challenge of Exxon to the 1980 revision, the NJDEP granted Exxon a separate hearing as to the appropriate water use classification for Morses Creek. In the letter granting the hearing, the NJDEP agreed that the regulation of Exxon's discharge into Morses Creek would continue in its existing status until the water quality standard issue was resolved. This hearing was not held.

13. In 1985, the NJDEP made a general reconsideration of all SWQS. SE-3 was the proposed classification for Morses Creek. This replaced the TW-3 designation with the same uses as previously established for TW-3. Exxon petitioned for a separate hearing on the appropriate standard for Morses Creek. At the suggestion of the NJDEP, Exxon also filed a conditional application for reclassification of Morses Creek to a less restrictive use. Again, no hearing was ever held.

14. In 1988, the NJDEP once more made a general reconsideration of the SWQS. The classification proposed for Morses Creek was SE-3. Exxon again petitioned for a separate hearing on the appropriate classification and filed a conditional application for a less restrictive use.

15. On December 1, 1989, Exxon, at the request of the NJDEP, filed a study on the appropriate Water Use Classification for Morses Creek.

16. On December 4, 1989, the NJDEP issued a public notice of a hearing to be held on January 30, 1990 for a determination on the legality of the water use classification of Morses Creek and

for reclassification to less restrictive uses.

17. Exxon appeared at the hearing on January 30,1990 and presented expert testimony on the appropriate classification of Morses Creek and support for its conditional application for reclassification.

18. On December 3, 1990, the NJDEP announced its decision on Exxon's petition and conditional application. It held that it had jurisdiction to establish SWQS for the entire length of Morses Creek, that Exxon had not documented its right to a hearing on the appropriate standard for Morses Creek and that Exxon had not proven that the criteria was satisfied for the reclassification of Morses Creek to less restrictive uses.

19. Contrary to the terms of the Grant, by the imposition of the SE-3 Water Use Classification on Morses Creek, the State of New Jersey is asserting the right of the public to use Morses Creek for fishing, boating and the migration and maintenance of fish and wildlife. The regulation establishing the SE-3 Classification will also force Exxon to discontinue the industrial use of the Creek for the discharge of the once through cooling and treated process water.

20. Article I, Section 10, Clause 1 of the United States Constitution provides:

> "No State shall enter into any Treaty, Alliance, or Confederation; grant Letters of Marque and Reprisal; coin Money, emit Bills of Credit; make any Thing but gold and silver Coin a Tender in Payment of Debts; <u>pass any Bill of Attainment, ex post facto Law, or Law impairing the Obligation of Contracts,</u> or grant any Title of Nobility." (Emphasis

Added).

21. The imposition of the SE-3 Water Use Classification for the establishment of public uses in Morses Creek is an impairment of the contractual obligations made by the State of New Jersey in the Grant to Exxon's predecessor in violation of Article 1, Section 10, Clause 1 of the United States Constitution.

WHEREFORE, the plaintiff Exxon demands judgment enjoining the State of New Jersey and the New Jersey Department of Environmental Protection from imposing any regulation of Exxon's use of Morses Creek which impairs the contractual obligations of the State of New Jersey in its 1927 Grant to Exxon's predecessor.

COUNT TWO

22. Plaintiff, Exxon Corporation repeats each and every allegation of the First Count as if set forth at length herein.

23. Plaintiff Exxon's right to use Morses Creek for its industrial purposes and to exclude the public from the use of the Creek constitutes a valuable property right which is protected under the Constitution of the United States.

24. The assertion by the State of New Jersey of the rights of the public in Morses Creek for recreation and the maintenance and migration of fish and wildlife constitutes the taking of private property for public use without just compensation in violation of the Fifth and Fourteenth Amendments to the United States Constitution and Article 1, Section 20 of the New Jersey Constitution.

WHEREFORE, plaintiff Exxon demands Judgment enjoining the

State of New Jersey and the New Jersey Department of Environmental Protection from taking the property of Exxon without just compensation.

CARLIN, MADDOCK, FAY & CERBONE, P.C.

By ______________________
John J. Carlin, Jr.
Attorneys for Plaintiffs

Of Counsel:

Kenneth D. McPherson
Waters, McPherson, McNeill

Dated: January 11, 1991

NOTICE OF APPEAL

PLEASE PRINT OR TY

SUPERIOR COURT OF NEW JERSEY - APPELLATE DIVISION

TITLE OF ACTION AS CAPTIONED BELOW:

Exxon Company, U.S.A. - Bayway Facility
N.J.P. DES Permit No. UJ0001511
Morses Creek Reclassification Request

ATTORNEY OF RECORD

NAME Carlin, Maddock, Fay & Cerbone, I

ADDRESS 30 Vreeland Road
Florham Park, New Jersey 07932

PHONE NO. (201) 377-3350

ATTORNEY FOR Exxon Company, U.S.A., a ~~division of Exxon Corp.~~

ON APPEAL FROM:

TRIAL COURT/STATE AGENCY New Jersey Department of Environment Protection

TRIAL DOCKET OR INDICTMENT NUMBER N/A

TRIAL COURT JUDGE

CIVIL [ ] CRIMINAL [ ] JUVENILE [ ]

NOTICE IS HEREBY GIVEN THAT Exxon Company, U.S.A., a division of Exxon Corporation

APPEALS TO THE SUPERIOR COURT OF NJ, APPELLATE DIVISION, FROM THE JUDGMENT [ ] ORDER [ ]

OTHER (SPECIFY) [x] Decision by New Jersey Department of Environmental Protection affirming S Classification of Morses Creek and denying Exxon's conditional applicatio for reclassification to a less restricted use

ENTERED IN THIS ACTION ON December 5, 1990 (DATE), ~~IN FAVOR OF~~ By New Jersey Department of Environm Protection

IF APPEAL IS FROM LESS THAN THE WHOLE, SPECIFY WHAT PARTS OR PARAGRAPHS ARE BEING APPEALED:

ARE ALL ISSUES AS TO ALL PARTIES DISPOSED OF IN THE ACTION BEING APPEALED? YES [X] NO [ ]

IF NOT, IS THERE A CERTIFICATION OF FINAL JUDGMENT ENTERED PURSUANT TO R. 4:42-2? YES [ ] NO [ ]

PRIORITY UNDER R. 1:2-5 YES [X] NO [ ] APPLICABLE SECTION UNDER THE RULE 1:2-5(1)

IN CRIMINAL, QUASI-CRIMINAL, AND JUVENILE CASES...NOT INCARCERATED [ ] INCARCERATED [ ]

CONFINED AT

GIVE A CONCISE STATEMENT OF THE OFFENSE AND OF THE JUDGMENT, DATE ENTERED AND ANY SENTENCE OR DISPOSITION IMPOSED

ATTACH ADDITIONAL SHEETS IF NECESSARY

1 NOTICE OF APPEAL HAS BEEN SERVED ON:

	NAME	DATE OF SERVICE	TYPE OF SERVICE
TRIAL COURT JUDGE	N/A	1/11/90	Cert. Mail
TRIAL COURT CLERK/STATE AGENCY	Department of Environmental Protection, CN402 ~~Trenton, New Jersey 08625-0402~~		
ATTORNEY GENERAL OR GOVERNMENTAL OFFICE UNDER R. 2:5-1(h)			

OTHER PARTIES:

NAME AND DESIGNATION	ATTORNEY NAME, ADDRESS & TELEPHONE NO.	DATE OF SERVICE	TYPE OF SERVICE
(SERVE THIS PARTY WITH TRANSCRIPT)			
	Robert J. Del Tufo, Jr., Esquire ~~Attorney General~~ CN-080, Trenton, New Jersey 08625	1/11/90	Cert. Mail

I HEREBY CERTIFY THAT I HAVE SERVED A COPY OF THIS NOTICE OF APPEAL ON EACH OF THE PERSONS REQUIRED AS INDICATED ABOVE.

1/11/91 (DATE)

SIGNATURE OF ATTORNEY OF RECORD
John J. Carlin, Jr.

2 PRESCRIBED TRANSCRIPT REQUEST FORM HAS BEEN SERVED ON:
(ALSO INDICATE IF SOUND RECORDED)

	NAME	DATE OF SERVICE	AMOUNT OF DEPOSIT
ADMINISTRATIVE OFFICE OF THE COURTS CHIEF, COURT REPORTING SERVICES	N/A		
COURT REPORTER'S SUPERVISOR/CLERK OF COURT OR AGENCY	New Jersey Department of Environmental Protection Bureau of Water Quality Standards & Analysis ~~Attn: Steven P. Lubow, Acting Section Chief~~		$300.00
COURT REPORTER	Identity of Reporter provided by DEP is unknown. (Request for transcript has been sent to agency hearing officer appellant has transcript prepared by Charles Mongolvi, C.S.R., who was hired by appellant.		

I HEREBY CERTIFY THAT I SERVED THE PRESCRIBED COURT TRANSCRIPT REQUEST FORM ON EACH OF THE ABOVE PERSONS AND PAID THE DEPOSIT AS REQUIRED BY R. 2:5-3(d).

1/11/91 (DATE)

SIGNATURE OF ATTORNEY OF RECORD
John J. Carlin, Jr.

3 I HEREBY CERTIFY THAT:

[ ] THERE IS NO VERBATIM RECORD.

[X] TRANSCRIPT IS IN THE POSSESSION OF THE ATTORNEY OF RECORD.

[ ] A MOTION FOR ABBREVIATION OF TRANSCRIPT HAS BEEN FILED WITH THE COURT OR AGENCY BELOW.

[ ] A MOTION FOR FREE TRANSCRIPT HAS BEEN FILED WITH THE COURT BELOW.

1/11/91 (DATE)

SIGNATURE OF ATTORNEY OF RECORD
John J. Carlin, Jr.

PRESCRIBED COURT TRANSCRIPT REQUEST FORM - R.2:5-3(a)

Exxon Corporation — [Name of party requesting transcript]

Bayway Refinery, 1400 Park Avenue, Linden, New Jersey 07036, Attn: David Mahoney, Esq. — [Address of party requesting transcript]

Carlin, Maddock, Fay & Cerbone, P.C. — [Name of attorney for party requesting transcript]

30 Vreeland Road - P.O. Box 751
Florham Park, New Jersey 07932 — [Address of attorney for party requesting transcript]

Exxon Corporation — [Name(s) of plaintiff(s)]

New Jersey Department of Environmental Protection Agency ("DEP") — [Name(s) of defendant(s)]

N/A (DEP Hearing) — [Lower Court docket no./ind. no./compl. no.]

N/A — [Court from which appeal taken]

To: New Jersey Department of Environmental ~~Protection Agency - Bureau of Water~~ — [Name of Court Reporter]*
Quality Standards & Analysis — [Address of Court Reporter]

CN-402, Trenton, New Jersey 08625-0402 ~~XXXXXXXXXXXXXXXXXXXXXXXXXXX~~

Attn: Steven P. Lubow, Acting Section Chief ~~[Address of Trial Court Clerk (if sound recorded)]~~

It is hereby requested that you prepare for use on appeal an original and 2 copies of the following:

Date(s) of Proceeding	Type of Proceeding (e.g., trial, sentencing, hearing on petition for post conviction relief)	Name of Judge
1/30/90	Administrative Hearing	Hearing Officer, Steven P. Lubow

Herewith is deposit for transcript in the amount of $300.00

1/10/91
[Date]

[Signature of pro se party or attorney requesting transcript]

(The Clerk's copy shall be attached to the notice of appeal - R.2:5-1(f))

cc: Clerk, Appellate Division, Superior Court**
Administrative Office of the Courts
Attn: Chief, Reporting Services

__________ [Reporter supervisor for the county]

__________ [Other attorneys and pro se parties]

*Note: If more than one reporter recorded a portion of the proceeding, a separate form shall be completed for each such reporter.

**Note: Where transcript is to be prepared for use in the Supreme Court rather than the Appellate Division, the copy shall be forwarded to the Clerk of the Supreme Court.

SUPERIOR COURT OF NEW JERSEY | APPELLATE DIVISION

CIVIL APPEAL CASE INFORMATION STATEMENT

TITLE IN FULL:

Exxon Company, U.S.A. - Bayway Facility
N.J.P. DES Permit No. UJ0001511
Morses Creek Reclassification Request

FOR OFFICIAL USE ONLY

Appeal Docket No.

Notice of Appeal Filed:

Date Sent:

APPELLANT'S ATTORNEY(S): ☐ Plaintiff ☐ Defendant ☐ Other (Specify)

Name	Address	Telephone	Client
Carlin, Maddock, Fay & Cerbone, P.C.	30 Vreeland Road P.O. Box 751 Florham Park, NJ 07932	(201) 577-5350	Exxon Company, U.S.A., a division of Exxon Corporation

RESPONDENT'S ATTORNEY(S)*:

Name	Address	Telephone	Client
(See Attached List)			

(*INDICATE WHICH PARTIES, IF ANY, DID NOT PARTICIPATE BELOW OR WHO WERE NO LONGER PARTY TO THE ACTION AT THE TIME OF ENTRY OF THE ORDER/JUDGMENT BEING APPEALED.)

GIVE DATE AND SUMMARY OF TERMS OF JUDGMENT ENTERED BELOW:

Does this determination dispose of *all issues as to all parties*? Yes X No ___
If not, has it been certified as final pursuant to *R.*4:42-2? Yes ___ No ___
(If not, leave to appeal must be sought. *R.*2:2-4, 2:5-6.)
Is the validity of a statute, executive order, franchise or constitutional provision of this state questioned: (*R.*2:5-1(h)). Yes ___ No X

GIVE A BRIEF STATEMENT OF THE FACTS AND PROCEDURAL HISTORY:

(See Attached)

TO THE EXTENT POSSIBLE, LIST THE PROPOSED ISSUES TO BE RAISED ON THIS APPEAL, AS THEY WILL BE DESCRIBED IN APPROPRIATE POINT HEADINGS PURSUANT TO *R.*2:6-2(a)(5). Appellant or cross appellant only.

(See Attached)

Civil Appeal Case Information Statement - Attached List

RESPONDENT'S ATTORNEY(S):

Name: Robert J. Del Tufo, Jr., Esquire
Address: Attorney General, CN-080, Trenton, New Jersey 08625
Telephone: (609) 292-4925
Client: State of New Jersey, Department of Environmental Protection
CN-402
Trenton, New Jersey 08625-0402

RIDER TO CIVIL CASE INFORMATION STATEMENT

GIVE DATE AND SUMMARY OF TERMS OF JUDGMENT ENTERED BELOW:

Exxon Company, U.S.A. ("the Appellant") filed a petition with the New Jersey Department of Environmental Protection ("NJDEP") challenging the jurisdiction of the NJDEP to impose Surface Water Quality Standards ("SWQS") in Morses Creek, contesting the legality of the SE-3 SWQS classification for Morses Creek and conditionally requesting a reclassification of Morses Creek to less restrictive uses. By letter dated December 3, 1990, the NJDEP informed Appellant that it determined that it had jurisdiction to establish SWQS in Morses Creek, that SE-3 was the appropriate classification and denied Appellant's conditional application for less restrictive uses in Morses Creek.

GIVE A BRIEF STATEMENT OF THE FACTS AND PROCEDURAL HISTORY:

Morses Creek is a small tidal inlet from the Arthur Kill located almost entirely within the confines of Appellant's petroleum refinery in Linden, New Jersey known as the Bayway Refinery. Since the inception of refinery operations in 1909, Appellant had used Morses Creek to return once through cooling water pumped in from the Arthur Kill. Appellant also discharges into Morses Creek treated process water and storm water runoff. These discharges are regulated by the NJDEP through its Pollution Discharge Elimination System under Permit No. NJ0001511. Prior to the NJDEP undertaking the issuance of discharge permits, the permitting system was administered by the Federal Environmental Protection Association ("EPA"). In 1974, EPA issued the initial draft permit for Appellant's discharge from the refinery. The NJDEP certified to EPA that the discharge permit had to meet New Jersey surface water quality standards for the Tidal Portion of Morses Creek. Upon the petition of Exxon for relaxation of the certification, the NJDEP reclassified the Tidal Portion of Morses Creek as TW4A Industrial Use. In 1976, the EPA approved New Jersey's reclassification. In 1980, the EPA rescinded its approval on procedural grounds. Appellant brought suit in Federal Court contesting EPA's actions. Appellant's suit was stayed and then dismissed without prejudice in November, 1980 due to the availability of administrative relief in a hearing to be held by the NJDEP as to the appropriate water use classification for Morses Creek. In the letter granting the hearing, the NJDEP agreed that the regulation of Exxon's discharge would be continued in its existing status until the water quality standard issue was resolved. In 1985, the NJDEP made a general reconsideration of all SWQS. Appellant petitioned for the separate hearing on the appropriate standard for Morses Creek since the hearing granted in 1980 had never been held. At the suggestion of the NJDEP, Exxon also filed a conditional application for reclassification of Morses Creek for a less restrictive use. No hearing was ever held. In 1988, the NJDEP again reconsidered its SWQS. Appellant again asked for a separate hearing on Morses Creek and filed a conditional application for reclassification. On December 1, 1989, Appellant filed with the NJDEP a study on the appropriate Water Use Classification for Morses Creek. On December 4, 1989, the NJDEP issued a public notice of a hearing on Appellant's petition for a determination on the legality of the water use classification of Morses Creek and for reclassification to less restrictive uses. The notice announced a public hearing on January 30, 1990 and a close of written comments on February 5, 1990. The public hearing was held as scheduled. On December 3, 1990, the NJDEP informed Exxon of its decision that it had jurisdiction to impose water quality standards in Morses Creek, that it determined that SE-3 was the appropriate classification and denied the application for less restrictive uses.

TO THE EXTENT POSSIBLE, LIST THE PROPOSED ISSUES TO BE RAISED ON THIS APPEAL, AS THEY WILL BE DESCRIBED IN APPROPRIATE POINT HEARINGS PURSUANT TO R.2:6(a)(5).

1. The NJDEP has no jurisdiction to establish water quality standards for public uses in that portion of Morses Creek which was the subject of a riparian grant to the predecessor of Exxon in 1927.

2. The hearing held by the NJDEP on the appropriate water quality standard for Morses Creek violated procedural due process in that:

(a) The burden of proof to establish the appropriate water quality standard for Morses Creek was improperly placed on Exxon thereby rendering the hearing a nullity;

(b) the decision was based in part on comments received after the close of the period for the submission of comments;

(c) the decision was based in part on alleged visual observations of members of the staff of the NJDEP without the submission of any written report or sworn oral testimony as to such observations;

(d) the decision was based in part on unsubstantiated hearsay contained in letters submitted by environmental groups.

3. The decision by the NJDEP was not supported by substantial evidence.

4. The decision of the NJDEP in denying Exxon's conditional application for reclassification was arbitrary and capricious in that:

(a) The NJDEP improperly refused to consider the impact of the discontinuance of Exxon's discharge in deciding whether the criteria necessary for reclassification was satisfied;

(b) the NJDEP improperly used a single pollution tolerant species as representative of fish populations;

(c) the NJDEP improperly determined that sporadic or random entry of fish into Morses Creek constituted migration of fish populations;

(d) the NJDEP improperly restricted the definition of "Canal" in the EPA Blue Book to artificially constructed water ways.

5. In addition, the action of the NJDEP constitutes a violation of Exxon's rights under the United States and New Jersey Constitutions. Exxon in order to satisfy New Jersey's entire controversy doctrine is simultaneously filing a separate complaint charging these violations in the United States District Court for the District of New Jersey.

I hereby certify compliance with R.2:5-1(f)(2), filing of Case Information Sheet and have attached a copy of same to this Notice of Appeal.

CARLIN, MADDOCK, FAY & CERBONE, P.C.

By John J. Carlin, Jr.
John J. Carlin, Jr.
Attorneys for Appellant,
Exxon Company, U.S.A.

Dated: 1/11/91

I hereby certify that payment of the Appellate Division filing fee of $20.00 has been submitted to the Clerk with the Notice of Appeal.

CARLIN, MADDOCK, FAY & CERBONE, P.C.

By John J. Carlin, Jr.
John J. Carlin, Jr.

Dated: 1/11/91

REQUEST FOR PUBLIC HEARING PURSUANT
TO N.J.S. 58:10A-8

To: Commissioner Judith Yaskin
New Jersey Department of Environment Protection

1. Exxon Company, U.S.A., a division of Exxon Corporation (hereinafter "Exxon") operates a petroleum refinery in the City of Linden known as the Bayway Refinery.

2. Since the inception of the Refinery in 1909, Exxon has discharged its once through cooling water pumped in from the Arthur Kill into Morses Creek, a small tidal inlet located almost entirely within the confines of the Bayway Refinery.

3. The discharge of the once through cooling water, together with treated process water and storm water runoff into Morses Creek is regulated by the Department of Environmental Protection ("DEP") through its NJPDES program under NJPDES Permit No. NJ0001511.

4. Permit No. NJ000511 expired in 1988 and the Bayway Refinery is currently operating under its terms and conditions as a Permit by Rule pursuant to N.J.A.C. 7:13A-1.9 and 2.3.

5. On December 3,1990, the DEP informed Exxon of its decision affirming the SE-3 classification for Morses Creek and denying Exxon's conditional application for reclassification.

6. In the letter informing Exxon of its decision, the DEP announced its intention to issue a draft renewal permit for Exxon's discharge which would incorporate more stringent water quality based effluent limitations necessary to achieve the designated water quality standards in Morses Creek. In the documentation

> affected by any such limitations demonstrates at the hearing that there is no reasonable relationship between the economic and social costs of compliance and the benefits to be obtained, the commissioner shall modify any such limitations as they may apply to that person."

9. Exxon is a person affected by the more stringent limitations which the DEP intends to establish for the discharges into Morses Creek.

10. In the course of the hearing held in January, 1990 by the DEP on Exxon's challenge to the SE-3 Classification of Morses Creek and the conditional application for reclassification, Exxon demonstrated that (1) there is no environmental benefit to the attempt to attain these water quality standards in Morses Creek if these more stringent effluent limitations are established; (2) there is no available technology that would permit Exxon to continue its discharges into Morses Creek; (3) the cost of removal of Exxon's discharge would be in excess of 100 million dollars; and (4) imposition of these limitations could result in cessation of refining operations at Bayway which would have widespread adverse social and economic impacts.

WHEREFORE, Exxon requests that you hold a public hearing to determine:

1. If there is a reasonable relationship between the economic and social costs of achieving more stringent effluent limitations for Exxon's discharges into Morses Creek, including any economic or social dislocation in the affected community or communities, and the social and environmental benefits to be obtained therefrom; and

2. Whether such effluent limitations can be implemented

Bill

Let's protect our earth

State of New Jersey

DEPARTMENT OF ENVIRONMENTAL PROTECTION

DIVISION OF WATER RESOURCES
CN 029
Trenton, N.J. 08625-0029

Jorge H. Berkowitz, Ph.D.
Acting Director

(609) 292-1637
Fax # (609) 984-7938

H.R. Van Handle, Sr. Staff Engineer
Exxon Company, U.S.A.
P.O. Box 222
Linden, New Jersey 07036-0222

MAY 09 1989

Dear Mr. Van Handle:

Re: Treatment of Bayonne Terminal Wastewater at Bayway
Bayway Refinery, NJPDES Permit No. NJ0001511

This is written in response to your letter dated January 13, 1989 requesting permission to treat process tank water draw bottoms from the Bayonne Terminal at the Bayway Refinery Wastewater treatment plant.

As indicated in your letter dated February 3, 1989, the Department granted verbal approval on January 31, 1989 for the Bayway facility to treat the subject tank bottom wastewater. Approval was granted as (1) the Bayway WWTP already treats other process wastewater from the Bayonne terminal (as indicated in the NJPDES permit administrative record), (2) the additional wastewater is analogous to that already treated and to Bayway's own wastewater, and (3) the volumes projected add negligible hydraulic load to the Bayway WWTP. Therefore, provided Exxon-Bayway maintains compliance with all effluent limitations imposed by the NJPDES/DSW permit, the Department has no objection to the Bayway Refinery continuing to accept the additional wastewater from the Bayonne Terminal.

Should you have any further questions regarding this matter, please contact me or Melisse Wilusz of my staff at (609) 292-4860.

Sincerely,

William F. Boehle

William F. Boehle, P.E., Acting Chief
Surface Water Section
Bureau of Industrial Discharge Permits

WFM70:CDG

K. Oberthaler

Let's protect our earth

State of New Jersey
DEPARTMENT OF ENVIRONMENTAL PROTECTION
JOHN S. KEITH, P.E.
Assistant Commissioner
for Environmental Management and Control
CN 402
Trenton, NJ 08625-0402
(609) 292-8058
Fax # (609) 633-1166

RECEIVED
13
DEC 0 3 1990
STATE OF NEW JERSEY
DEPT. ENVIRONMENTAL PROTECTION
DIVISION WATER RESOURCES
BUR. OF IND. WASTE MGMT.

DEC 0 3 1990

Mr. H.R. Van Handle
Senior Staff Engineer
Exxon Company U.S.A.
Bayway Plant
P.O Box 222
Linden, N.J. 07036-0222

Dear Mr. Van Handle:

Re: Exxon Co. USA - Bayway Facility
NJPDES Permit No. NJ0001511
Morses Creek Reclassification Request

This letter is to inform you of the final decision regarding the requested reclassification of a portion of Morses Creek between Exxon Company USA's (Exxon) #2 Dam and the confluence with the Arthur Kill. The Department, after careful consideration of the information submitted, has determined that the existing SE3 classification of Morses Creek, defined in N.J.A.C. 7:9-4.1 et seq., is appropriate. A copy of the documentation supporting this decision is enclosed for your information and records. Basically, the Department has concluded that, although the existing water quality of Morses Creek is not good, the stream (which we firmly believe is and must be treated as a natural water course) has significant ecological value, and could have more value if the quality of process and cooling water discharges from Exxon's operation were improved and contaminated sediments were addressed.

The Department's decision addresses longstanding issues regarding Morses Creek and will allow the issuance, in the very near future, of a draft NJPDES/DSW renewal permit incorporating water quality based effluent limitations necessary to achieve the designated water quality standards in Morses Creek. In order to properly regulate Exxon's discharges, the Department plans to require Exxon to identify all point source discharges from the facility to Morses Creek. This identification process will consist of indicating the type and amount of pollutants discharged from each outfall, and the frequency of the discharge. An effluent characterization of the wastewater discharged from each outfall and a U.S.G.S. map showing where these discharge points are located will be required with a site specific detailed drawing of each outfall.

As part of the upcoming NJPDES permit process, Exxon may opt to pursue a thermal variance (316 variance) in accordance with N.J.A.C. 7:14A-9.6. In addition, Exxon may choose to seek a modification, if appropriate, from any water quality based effluent limitation imposed in the future NJPDES/DSW renewal permit in accordance with N.J.A.C. 7:9-4.9(a). Exxon may also choose to reconfigure its piping to combine its storm and cooling water discharges into one pipe that would discharge to the Arthur Kill. The Department understands the concerns that led Exxon to request a reclassification of Morses Creek. Upon thorough review of the issues raised and their legal and regulatory framework, we believe that addressing these type of issues through modification and variance requests under 7:14A-9.6 and 7:9-4.9(a), would be more appropriate than reclassifying Morses Creek to a lesser use. Understand, however, that the Department is not stating that such requests would be approved; such a determination could only be made after receipt of the requests and full evaluation of the technical, regulatory and environmental issues involved. The Bureau of Industrial Discharge Permits will be available to discuss any of the options available to Exxon that you may wish to pursue.

With respect to the contaminated sediments of the subject water body, the Department has determined that an investigation and remediation of the sediments shall be conducted as a part of, and in accordance with the Administrative Consent Order currently being negotiated by Exxon and the Department's Responsible Party Clean-up Element. In the interim all existing environmental control measures such as booms, oil/skimmers, etc, shall remain in place.

Should you have any questions regarding this decision, please contact this office at your earliest convenience.

Sincerely,

ORIGINAL SIGNED

John S. Keith, P.E.

enclosure

c: Chief Shing-Fu Hsueh, BWQSA
Chief Robert Oberthaler, BIDP
Chief Peter Lynch, MBRE

bcc: Assistant Commissioner John Keith
Acting Assistant Director John Fields, WFME
Acting Assistant Director George Horzepa, PNSE
Assistant Director James Hamilton, Enforcement Element
Assistant Director Dennis Hart, RPCE
DAG Ronald Heksch

DAG Martin McHugh
DAG Thomas A. Borden
Barbara Dietz Kantor, BFCM
Ben Manhas, BIDP
Meredith Lavery, BWQSA

1/13/91 Trenton Times

Exxon sues to block N.J. ban on dumping in Morses Creek

NEWARK (AP) — Exxon has filed legal actions to block a state ruling that would bar it from dumping polluted water into a creek near its Bayway refinery in Linden.

The state Department of Environmental Protection in December ordered the company to refrain from dumping waste water into Morses Creek unless it installs more pollution controls. The state said it wanted the water quality of the 1.7-mile tributary to improve enough for the creek to support aquatic life.

In one action Friday, Exxon asked a state court to review the department decision upgrading the classification of the creek. In a separate lawsuit filed in federal court, Exxon claimed that the department decision would constitute a taking of property without just compensation.

Dwight Wiggins, Bayway's manager, said negotiations with the regulatory agency would continue. Last year, company representatives said the dumping restrictions could jeopardize the future of Bayway, which employees 1,000 workers and pays about a third of Linden's property taxes.

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JOHN J. CARLIN, JR.
LAURENCE R. MADDOCK
DONALD J. FAY
RICHARD R. CERBONE
ARTHUR G. WARDEN, III

August 2, 1991

Nancy Stiles,
Deputy Attorney General
State of New Jersey
CN 402
Hughes Justice Complex
Trenton, New Jersey 08625

Re: Limitations on Once Through Cooling Water
Exxon Company, U.S.A. - Bayway Refinery
NJPDES Permit No. NO0001511

Dear Ms. Stiles:

Enclosed herewith is original and one copy of Request for Modification of Water Quality Based Effluent Limitations pertaining to Exxon's discharges into Morses Creek. There is contained within the Request the time schedule for submission of information and data required for the holding of a public hearing. We are still awaiting confirmation by the Department as to the content of this information and data.

Very truly yours,

CARLIN, MADDOCK, FAY & CERBONE, P.C.

By John Carlin

JJC,JR:ja
Hand Delivered

REQUEST FOR MODIFICATION OF WATER QUALITY BASED EFFLUENT LIMITATIONS PURSUANT TO N.J.A.C. 7:9-4.9

To: Commissioner Scott A. Weiner
New Jersey Department of Environmental Protection

1. On July 24, 1991, Exxon Company, U.S.A. received a draft New Jersey Pollutant Discharge Elimination System ("NJPDES") Discharge to Surface Water ("DSW") Permit for its Bayway Refinery, together with Public Notice thereof and an accompanying letter from Assistant Commissioner John Keith, setting forth provisions for holding an expedited public hearing on the thermal limitations to be established for Exxon discharges into Morses Creek.

2. On July 23, 1991, Exxon replied to Commissioner Keith's letter, reaffirming its desire for a public hearing pursuant to N.J.S. 58:10A-8 and stating that Exxon would be submitting under separate cover a request for modification of effluent limits pursuant to N.J.A.C. 7:9-4.9. Attachment I to this reply sets forth the information and data to be submitted by Exxon relevant to limits for discharge of the once through cooling water. A copy of Attachment I is annexed hereto.

3. The June 24, 1991 letter from Commissioner Keith sets forth the intention of the Department to establish water quality based effluent limitations, including thermal limits, for the individual discharge points into Morses Creek of Exxon's once through cooling water.

4. The Draft Permit contained conditions, study requirements and effluent limits for the two regulated outfalls at the refinery,

which are designated DSN-001 (No. 1 Dam) and DSN-002 (discharge from Bayway's Waste Water Treatment Facility). Several of the draft effluent limits for outfall DSN-002, which are presented on page 4 of 29 through page 7 of 29 in the Fact Sheet, are water quality based limits. The parameters with water quality based effluent limits are presented below:

Parameter	**Water Quality Based Limit** **Mtly Avg/Daily Max**
Chlorine Produced Oxidants (ug/l)	6.32/12.68
Chlorine Produced Oxidants (kg/d)	0.18/0.36
Cyanide (ug/l)	0.53/1.06
Cyanide (kg/d)	0.01/0.03
Lead (ug/l)	4.7/9.4
Lead (kg/d)	0.13/0.27
Zinc (ug/l)	41/103
Zinc (kg/d)	1.2/2.9
Chromium (total) (kg/d)	8.42/16.89
Chronic Toxicity	NOEC ≥ 100%

With the exception of Chromium, each of the draft water quality based effluent limits proposed for DSN-002 was identified as being more stringent that the associated technology based effluent limit. The draft permit also contains requirements for various studies and investigations to support the water quality based effluent limits or to establish future water quality based effluent limits.

5. Exxon requests pursuant to N.J.A.C. 7:9-4.9 that the water quality based effluent limitations be modified for:

A. The individual discharge points of once-through cooling water, specifically:

1. Alternative limits should be established for the thermal limits of 85 degrees F. and differential in discharge of 4 degrees F. from September through May and 1.5 degrees F. from June through August;

2. The prohibition of presence of sheen due to fugitive leaks in the once through cooling water system should be eliminated;

3. Provision should be made for net limitations based upon contents on the intake of the once through cooling water.

B. As to the outfall DSN-002, alternative effluent limits should be established for each of the parameters referenced in 4 above and all water quality associated studies and investigations should be modified or eliminated.

6. It is recognized that the subject matter of the expedited public hearing will encompass only the request for modification of the effluent limits for the once through cooling water component of Exxon's discharge as set forth in 5(A) above. The required information and data for the holding of such hearing, as set forth in Attachment I, will be submitted by Exxon to the Department by November 15, 1991. Some of the engineering studies set forth therein are being done by outside contracting firms but it is anticipated that they will be completed within this time frame.

Respectfully submitted,

EXXON COMPANY, U.S.A.

By: ______________________
John J. Carlin, Jr.
Attorney for Exxon Company, U.S.A.

Dated: August 2, 1991

Attachment I

Information To Be Submitted
For Discharge Of Once Through Cooling Water

A. Report

1. Alternatives to existing cooling water system operating process, practices, and facilities which may have the potential to reduce thermal discharge.

   [The impingement and entrainment portions are deleted since they pertain to the intake only and not the thermal effect of the receiving waterbody. This is consistent with the Department's omission of items 8A-1 and 6].

2. The age of the equipment and facilities involved with the permittee's cooling water system.

3. The processes employed in the permittee's cooling water system.

4. Engineering-specific aspects of each cooling water system alternative. This shall include, but not be limited to, impacts such as process changes, safety, product quality, and reliability.

5. The intake flow and discharge flow at each discharge and reductions in flows attainable with each cooling water system alternative.

6. The thermal characteristics; including discharge temperature, rise in temperature from intake, and heat loading in BTU per unit time attainable at each outfall with each cooling water system alternative.

7. The construction and operating costs of each cooling water system alternative.

8. Non-water quality environmental impacts, including energy requirements, of each cooling water system alternative.

B. Model

The permittee shall develop and document a valid model representing the effects of its discharges upon thermal water quality in the receiving waters. This model shall be developed, applied, and presented so as to:

[The word "verified" has been deleted since verification would require field sampling during both summer and winter which would unduly delay the submission of data].

1. Indicate the effects of dilution provided by the receiving waters.

2. Indicate the cumulative effects of all discharges upon water quality in the receiving waters.

[Exxon agrees there is no natural dry weather flow over No. 2 Dam, but disagrees with the statement as what should result from this].

3. Indicate the ambient temperature, as defined in N.J.A.C. 7:9-4.4, of the receiving waters beyond the portion of the waterbody that is affected by the localized heated waste discharge or discharge complex, or the temperature of a waterbody that would exist without addition of heated discharges.

4. Indicate the percentage of the cross section and volume of the receiving waters which would result from each cooling water system alternative which: (i) could exceed ambient temperature by more than 4 degrees F from September through May; (ii) could exceed ambient temperature by more than 1.5 degrees from June through August; and (iii) could exceed 85 degrees F.

5. Indicate the percentage of the surface, from shore to shore, of the receiving waters which would result from each cooling water system alternative which: (i) could exceed ambient temperature by more than 4 degree F from September through May; (ii) could exceed ambient temperature by more than 1.5 degrees F from June through August; and (iii) could exceed 85 degrees F.

6. The surface and cross section areas indicated in 4 and 5 shall also be verbally described, such as by meets and bounds, and presented in suitable graphic form.

7. Development and application of this model shall be thoroughly documented in detail sufficient for independent critical review, indicating how the model conforms to reasonable engineering study methods, how the model was based upon data collected during dilution and other studies, and how protective (conservative) assumptions are used throughout the modelling process.

[Verification is removed due to the reason set forth above. "Best scientific methods" is changed to "reasonable engineering study methods" since the model will not be verified completely].

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ARTHUR G. WARDEN, III

RECEIVED
7 1991

May 17, 1991

Scott Weiner, Commissioner
New Jersey Department of Environmental
Protection
401 East State Street
Trenton, New Jersey 08625

Re: Exxon - Morses Creek

Dear Commissioner Weiner:

On January 17, 1991, Exxon submitted a request for a public hearing pursuant to N.J.S. 58:10A-8 to determine whether there is a reasonable relationship between the economic and social costs of achieving more stringent effluent limitations for Exxon's discharges into Morses Creek and the social and environmental benefits to be obtained therefrom. (Copy attached hereto). The purpose of this memorandum is to demonstrate that Exxon is entitled to such a hearing. In order to evaluate this issue, it is first necessary to be aware of the history of Exxon's use of Morses Creek and the regulation of such use by the NJDEP and its predecessors.

<u>History of the Use and Regulation of Morses Creek</u>

Morses Creek is a small tidal inlet from the Arthur Kill located almost entirely within the confines of the Exxon Bayway Refinery in Linden, New Jersey. (See attached aerial photo). Since the inception of the Bayway Refinery in 1909, Morses Creek has been used by Exxon to return water pumped in from the Arthur Kill to cool process equipment. The noncontact cooling water is discharged between two dams. Upstream, No. 2 Dam, which was constructed in 1922, impounds fresh water to be used in the process operation. Treated process water from Bayway's Waste Water Treatment Facility is also discharged just below the upstream dam. Downstream No. 1 Dam controls tidal flow upstream and acts as spill protection for the Arthur Kill.

These discharges constitute over 99% of the dry weather flow in Morses Creek. In January, 1927, the Standard Oil Company, the predecessor to Exxon obtained a Grant ("the Grant") from the State of New Jersey. The Grant conveyed all the rights of the State of New Jersey to the lands under the tide-water lying within the bed of Morses Creek. The only portion of Morses Creek not covered by the Grant is a short 500 foot segment between the Koehler Way Bridge and the confluence with the Arthur Kill. In 1938, the State granted formal approval for the dams on Morses Creek. Also in 1938, Morses Creek above the Koehler Way Bridge, was declared non-navigable by the Army Corps. of Engineers. In 1952, No. 2 Dam was reconstructed under a permit issued by the State. In 1963, Dam No. 1 was relocated and reconstructed under a permit issued by the State.

No attempt was made by the State to regulate Exxon's use of Morses Creek until the advent of the National Pollution Discharge Elimination System ("NPDES") Permit Program established by the federal government. The EPA initially issued a draft Permit to Exxon with the receiving waters designated as the Arthur Kill. In 1973, the New Jersey Department of Environmental Protection ("NJDEP") certified to EPA that there was no effluent limit or standard applicable to Exxon's discharge. In December, 1974, the NJDEP reversed its position and certified to the EPA that Exxon's discharge had to meet water quality standards in the Tidal Portion of Morses Creek. In July, 1975, in response to Exxon's petition for relief, the NJDEP amended its water quality standards to reflect Exxon's industrial use of the Creek. In 1980, the NJDEP first proposed a water quality use of maintenance and migration of fish and secondary contact recreation for the Tidal Portion of Morses Creek. Enforcement of this regulation was held in abeyance pending a hearing on its appropriateness and legality. (See letter of Ass't. Director Clark attached).

Without holding such a hearing, the NJDEP in 1985 proposed to amend the Water Quality Standards to classify Morses Creek as SE-3 and delete the separate thermal criteria and the measuring point below No. 1 Dam. Exxon again requested a hearing on the appropriateness of this standard and at the suggestion of the NJDEP also filed a conditional request for a reclassification of Morses Creek to Industrial Use. Without holding a hearing on these requests, the NJDEP proposed amendments to the Water Quality

Standards in 1988. Exxon again requested a separate hearing and filed for a conditional reclassification. In January, 1990, a hearing on Exxon's petition was finally held. On December 3, 1990, the NJDEP rendered its decision. It determined that it had the legal jurisdiction to set Water Quality Standards for all of Morses Creek. Despite the existence of the letter from Director Clark, it was determined that Exxon had not documented its right to a hearing on the appropriateness of the SE-3 classification for Morses Creek. As to the conditional application for reclassification, the NJDEP concluded that Exxon failed to carry the burden of proof that it was entitled to a reclassification to an Industrial Use. In the Decision, the NJDEP announced its intention to enforce the use classification of SE-3 waters in Exxon's NPDES Permit. The designated uses, as set forth in N.J.A.C. 7:9-4.12(f) are:

> (f) In all SE3 waters the designated uses are:
>
> 1. Secondary contact recreation;
> 2. Maintenance and migration of fish populations;
> 3. Migration of diadromous fish;
> 4. Maintenance of wildlife; and
> 5. Any other reasonable uses.

Secondary contact recreation is defined in N.J.A.C. 7:9-4.4. as follows:

> "Secondary contact recreation" means recreational activities where the probability of water ingestion is minimal and includes, but is not limited to, boating and fishing."

The imposition of these requirements will force Exxon to discontinue its present industrial use of the Creek. Exxon's detailed studies demonstrate that the relocation of the discharge alone will cost over $100 million dollars. The additional operating costs will be over five million dollars per year. The elimination of Exxon's discharges will result in a dry creek bed most of the year. During periods of rain, it will become a storm water ditch. Not one of the SE-3 designated uses will be achieved in Morses Creek. It is unlikely that any responsible management would ever agree to incur an expenditure of this magnitude which would result in an environmental detriment to its property and the neighboring Arthur Kill. Imposition of the SE-3 water uses on Morses Creek not only will cause cessation of Exxon's discharges into Morses Creek but also most probably will end refining operations at Bayway.

I.

THE STATUTORY PRE-REQUISITES FOR A PUBLIC HEARING PURSUANT TO N.J.S. 58:10A-8 HAVE BEEN SATISFIED.

N.J.S. 58:10A-8 (hereinafter referred to as "Section 8") provides as follows:

> "Whenever the commissioner finds that discharges from a point source or a group of point sources with the application of the effluent limitations authorized in this act, which effluent limitations are as stringent as the best available technology economically achievable as provided for in the Federal Act or State law, would interfere with the attainment and maintenance of applicable water quality standards, the commissioner may establish more stringent effluent limitations for each such point source or group of point sources, which effluent limitations can

> reasonably be expected to contribute to the attainment and maintenance of the applicable water quality standards. Prior to the establishment of any more stringent effluent limitations under this section, the commissioner shall publish a notice of his intent to establish such limitations and, upon request of a person affected by any such limitations, the commissioner shall hold a public hearing to determine if there is a reasonable relationship between the economic and social costs of achieving such limitations, including any economic or social dislocation in the affected community or communities, and the social and environmental benefits to be obtained, including the objective of restoring and maintaining the water quality of the State, and to determine whether such effluent limitations can be implemented with available technology or with other control strategies. If a person affected by any such limitations demonstrates at the hearing that there is no reasonable relationship between the economic and social costs of compliance and the benefits to be obtained, the commissioner shall modify any such limitations as they may apply to that person."

There are therefore three prerequisites to the holding of the public hearing:

1. The Commissioner must publish his intention to establish effluent limitations for a point source that are more stringent than best available technology economically achievable in order to attain applicable water quality standards.

2. The effluent limitations must be more stringent than best available technology economically achievable as provided for in the Federal Act. (<u>33 U.S.C.A. 1251</u>, <u>et seq</u>.).

3. A person affected by such limitation must request a public hearing.

In its decision issued December 3, 1990 ("December Decision"), the NJDEP found that the appropriate water quality classification of Morses Creek is SE-3. The designated uses for SE-3 include (1) secondary contact recreation; (2) maintenance and migration of fish populations; (3) migration of diadromous fish; (4) maintenance of wildlife; and (5) any other reasonable use. N.J.A.C. 7:9-4.12(b). Secondary contact recreation includes boating and fishing. N.J.A.C. 7:9-4.4. In its December Decision, the notice of which was published in the New Jersey Register on January 7, 1991, 23 N.J.R. 129, the NJDEP proclaimed on page one that it would issue to Exxon a draft NPDES/DSW renewal permit incorporating water quality based effluent limitations necessary to achieve the designated water quality standards in Morses Creek. Surface Water Quality Standards is defined in N.J.A.C. 7:9-4.4 as:

> "Surface Water Quality Standards" means the New Jersey rules which set forth a designated use or uses for the waters of the State, use classifications, water quality criteria for the State's waters based upon such uses, and the Department's policies concerning these uses, classifications and criteria."

"Criteria" is defined in N.J.A.C. 7:9-4.4 as:

> "Criteria means those elements of the Surface Water Quality Standards, expressed as constituent concentrations, levels, or narrative statements, representing a quality of water that supports a particular use. When the criteria are met, water quality will generally protect the designated use."

N.J.A.C. 7:9-4.14(c) contains the thermal criteria for SE-3 waters as follows:

> "(iv) No thermal alterations which would cause temperatures to deviate from ambient by more than 2.2 degrees C (4 degrees F), from September through May, nor more than 0.8 degrees C (1.5 degrees F) from June through August, nor cause temperatures to exceed 29.4 degrees C (85 degrees F).

There is no heat dissipation area in Morses Creek since Exxon's discharges constitute 99% of the dry weather flow. The thermal criteria therefore operates as an effluent limit on Exxon's discharges. Wisconsin Elect. Power Co. v. Department of Natural Resources, 93 Wis. 2d 222, 287 N.W.3d 113 (1980); Niagara of Wisconsis Paper Corp. v. Wisconsin Dept. of Natural Resources, 84 Wis. 2d 32, 268 N.W.2d 153 (1978). Additionally, at page 24 of the Documentation accompanying the December Decision, it is stated that additional water quality based toxic substance limitations will now be required to be in Exxon's draft permit. Therefore, as to the first prerequisite, the Commissioner in the December Decision has unequivocally announced the intention of the NJDEP to include in Exxon's draft permit effluent limitations to achieve SE-3 water quality standards in Morses Creek. [1]

It must next be considered whether the thermal limits to establish the SE-3 uses in Morses Creek would be more stringent

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[1] Any attempt to postpone the inevitable confrontation of this issue by not immediately including the 85 degree thermal limit and differential heat addition limit in Exxon's Draft Permit cannot succeed. The inclusion of these water quality based limits is mandatory under N.J.A.C. 7:9-4.6.

than the best available technology economically available as provided for in the federal Clean Water Act ("CWA") or state law. Best Available Technology Economically Achievable ("BAT") is defined in Section 301 of the CWA as technology required to meet the effluent limits established by the Administrator under Section 304 (b)(2) to meet guidelines for particular industrial categories of point sources. The Bayway Refinery as a petrochemical operation is covered by the Effluent Guidelines and Standards for Petroleum Refining and Organic Chemicals. As stated at page 35 of the Documentation accompanying the December Decision, Exxon discharges are currently meeting the effluent limitations required by Section 301(b) of the CWA. [2] It is stated further in the Documentation at page 23, that the thermal limitation in Exxon's NPDES permit now in effect is less stringent than would be required to meet the ambient criterion for SE-3 waters. Additionally, at page 24 of the Documentation, it is stated that additional water quality based toxic substance limitations will now be required to be in Exxon's draft permit under Section 304(l) of the CWA. Analysis of the content of Petroleum Refining Guidelines supports the conclusion that the effluent limitations which the NJDEP have stated must be in Exxon's permit are more stringent than required by the Guidelines. Under Section 419.23(e) of the Petroleum Refining Guidelines for a refinery of Bayway's sub-category, the quantity

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[2] It is significant to note that the discharge from Exxon's Waste Water Treatment Facility, as demonstrated by internal waste stream monitoring, is meeting Guideline limits <u>prior</u> to the discharge into Morses Creek.

and quality of pollutants attributable to once-through cooling water are excluded from the discharge permitted by application of BAT. The only limit placed upon once through cooling water is that it be discharged with a Total Organic Carbon concentration not to exceed 5 mg/l. Certainly, any requirement that once through cooling water be cooled before discharge is more stringent than BAT as established by Guidelines. Therefore, as to the second prerequisite, the effluent limits which are to be placed in Exxon's discharge permit in order to attain SE-3 water quality are more stringent than required by the application of BAT as provided for in the CWA.

The third and final requirement is that there be a request for a public hearing by a person affected by such limitations. There can be no question that Exxon as the permittee of discharges into Morses Creek is a person affected by such limitations and that the document it filed on January 17, 1991, constitutes a request for a public hearing.

II.

THE HOLDING OF A HEARING BY THE COMMISSIONER PURSUANT TO N.J.S. 58:10A-8 IS NOT PRECLUDED BY FEDERAL LAW.

It is understood that some staff members of the NJDEP have expressed concern that the Commissioner is precluded from granting a hearing under Section 8 because the standard for relief is different under the state act than under federal law. Under

Section 302(b) of the Clean Water Act, 33 U.S.C. 1312(b), there is a parallel proceeding under federal law for a mandatory public hearing by the Administrator of EPA. At such hearing, an applicant for a discharge permit is given the opportunity to demonstrate that more stringent effluent limitation to achieve water quality standards should not be imposed. Prior to 1987, the provisions of Section 302 and Section 8 were virtually identical. [3] In 1987, Section 302 was modified by the enactment of the Water Quality Act. The amendment to Section 302 was made in order to facilitate the establishment of stricter effluent limitations for priority pollutants for streams identified under Section 304(l) as requiring special treatment. The standard for relief from more stringent effluent limitations under Section 302(b) 2A for pollutants other than toxic pollutants remains exactly the same - "whether or not there is a resonable relationship between the economic and social costs and the benefits to be obtained." The definition of "pollutant" in 33 U.S.C. 1362(6) includes heat. Therefore, there is nothing under federal law that would preclude a public hearing under Section 8 prior to the establishment under state authority of conventional (non-toxic) pollutant effluent limitations, including thermal limits. On the contrary, Section 302(b) mandates the holding of a public hearing by the Administrator of EPA prior to the establishment by federal action of any more stringent effluent limitation.

[3]. The text of the pertinent provisions of Section 302 before and after the 1987 amendment is attached hereto.

The only effect that Section 302 has on the holding of a public hearing under Section 8 is to limit the extent that a successful demonstration can require modification of more stringent effluent limitations.

The 1987 amendment to Section 302(b) may preclude relief under the state hearing from the establishment of more stringent effluent limitations under Section 302(a) for toxic pollutants in streams which have been properly included on the Section 304(l) Short List. The standard for relief from more stringent effluent limitations for toxic pollutants is now whether the modified requirements "will represent the maximum degree of control within the economic capability of the owner and operator of the source." (See Text of Section 302). This section would be applicable only to a federal hearing and only if Morses Creek has been properly included on the 304(l) Short List. No where is Morses Creek specifically identified on the 304(l) Short List. [4] Exxon's Bayway Refinery has been included on the list of facilities compiled by the DEP for its impact on the Arthur Kill which is a stream on the 304(l) Short List. [5] The procedural requirements for inclusion of Morses Creek on the Section 304(l) Short List have not been satisfied. Assuming

4. See 304(l) Short List Streams attached hereto.

5 Exxon realizes that its discharge from the Waste Water Treatment Facility may well be impacted by the waste load study to be done by the NJDEP on the Arthur Kill. Since this discharge is measured prior to entry into Morses Creek, any more stringent limits that may be required can be handled in the NPDES permitting process without reference to water quality standards in Morses Creek.

they were, the 1987 amendment to Section 302(b) still does not provide a basis for the Commissioner of the DEP not providing Exxon a public hearing under Section 8. If Morses Creek is properly on the Section 304(l) Short List, the amendment to Section 302 will merely limit the effect of a successful demonstration by Exxon at the State hearing to modification of more stringent effluent limitations for conventional (non-toxic) pollutants, including thermal.

An additional concern, put forth by the NJDEP staff regarding Exxon's request for a hearing, is that the NJDEP is precluded by federal regulation from establishing any effluent limitation that will not result in the attainment of a designated water quality standard. This is based on the premise that the NJDEP in issuing Exxon's NPDES Permit is acting in the place of the federal EPA. It is hypothesized that since the Administrator of the EPA under Sections 301 and 302 of the CWA is obligated to establish more stringent effluent limitations to meet state water quality standards, a state law such as Section 8, cannot operate to alter this obligation. This contention is specifically negated by federal regulations. Section 123.25 of 40 C.F.R. (copy attached), which governs state participation in the NPDES program, specifically permits states to grant the relief requested by Exxon. This Section provides in part "... In all cases, States are not precluded from omitting or modifying any provision to impose more stringent requirements." Therefore, the decision by the

Commissioner as to whether or not to modify the SE-3 water quality based effluent limitations before inclusion in Exxon's NPDES Permit is to be made by application of New Jersey law.

It is also understood that the NJDEP staff maintains that federal law precludes the establishment by a state of an industrial use classification or one that does not include fishable and swimmable. In Associated Industries of Alabama v. Train, 9 ERC 1561 (N.D. Alabama 1976) it was held that the EPA could not prevent Alabama from establishing a water use less stringent than the protection of fish and wildlife and secondary contact recreation. At the present time, twenty seven states, including Alabama, have industrial water use classifications. [6] Fourteen other states and the federal EPA have provisions for excluding waste water discharge channels from water quality standards or provide a mechanism to obtain an exception from the standards. (See updated survey attached hereto).

It is an anomaly that of all the states, New Jersey is asserting federal preemption in an area traditionally reserved to the States land use control. The legislative history to the Water Quality Act of 1965, clearly demonstrates that it was never the intention of Congress to remove from the states the power to designate the uses for even interstate waters, much less local

[6] "Designated Uses - Water Quality Standards Criteria Summaries: A Compilation of State/Federal Criteria." EPA 440/15-88/008, September, 1988.

streams that flow into interstate waters. In House report No. 215, it is stated at p. 3322:

> Both H.R. 3988 and S. 4, as referred to the committee, would have authorized the Secretary of Health, Education, and Welfare to prepare regulations setting forth standards of water quality to be applicable to interstate waters or portions thereof. These standards would have been promulgated and would have been mandatory if, within a reasonable time after being requested by the Secretary to do so, the appropriate States and interstate agencies had not developed standards found by the Secretary to be consistent with the stated purpose of the bill.
>
> We are strongly opposed to such a provision. Standards of water quality are concededly badly needed, but should be established by the State and local agencies, which are most familiar with all aspects of the matter in a given locality, including the economic impact of establishing and enforcing stringent standards of water quality. Authorizing the Secretary of Health, Education, and Welfare to promulgate and enforce such standards to the exclusion of the States would obviously discourage the States and local agencies from developing their own plans and standards for water quality and purity. And it would place in the hands of a single Federal official the power to establish zoning measures over - to control the use of - land within watershed areas in all parts of the United States. Such power over local affairs has never been vested in a Federal official, and we are opposed to doing it now.

The position now being taken by the NJDEP goes far beyond the situation which Congress wished to avoid. The NJDEP believes that it is limited by federal regulation to establishing water uses that are at a minimum fishing and water recreation. By the NJDEP's own interpretation, all waters in New Jersey, including private streams and ponds must be classified for water use. The NJDEP further believes that it is prevented by federal regulation from modifying effluent limitations necessary to achieve water use even though these effluent limitations are stricter than required by federal law. What will be effectuated by implementation of this process is that, through supposedly federally mandated water use restriction, major manufacturing, electrical power plants and even large farms will be zoned out of New Jersey. This was not the intent of Congress in passing the federal laws to control water pollution. See Associated Industries of Alabama v. Train, supra, at 1571.

CONCLUSION

Exxon has requested a public hearing pursuant to Section 8. Section 8 provides that upon the request of a person affected, the Commissioner "shall hold a public hearing ...". The statutory use of the imperative in this context makes the granting of the hearing mandatory. Houman v. Mayor & Coun. Bor. Pompton Lakes, 155 N.J. Super. 129, 149 (Law Div. 1977). The request for the hearing is not premature as Section 8 provides that the notice of intent of the Commissioner, from which the request for the hearing flows, must be given "prior to the establishment of any more stringent affluent limitations."

Exxon believes that it will be able to demonstrate at this hearing that there is no reasonable relationship between the economic and social costs of achieving effluent limitations to attain SE-3 water quality uses in Morses Creek and the social and environmental benefits to be obtained. A successful demonstration by Exxon at such hearing would give the Commissioner the flexibility to set reasonable effluent limits in Morses Creek without endangering the viability of refining operations at Bayway. The forum of a public hearing would allow for the presentation of various points of view as to the regulation of Morses Creek, including environmentalists, labor, and citizens and representatives of the affected communities. It is Exxon's belief that this hearing provides the only possibility for a reasoned resolution of the issues concerning Morses Creek.

Respectfully submitted,

CARLIN, MADDOCK, FAY & CERBONE, P.C.

By ______________________
John J. Carlin, Jr.

Of Counsel:

____
Kenneth McPherson, Sr.

____
David J. Mahoney, Jr.

LIST OF EXHIBITS

1. Request for Public Hearing
2. Aerial photograph
3. Letter of Assistant Director Clark
4. Text of Section 302 of the Clean Water Act
5. Compilation of Short List Streams
6. Section 123.25 of 40 CFR
7. Updated survey

REQUEST FOR PUBLIC HEARING PURSUANT
<u>TO N.J.S. 58:10A-8</u>

To: Commissioner Judith Yaskin
New Jersey Department of Environment Protection

1. Exxon Company, U.S.A., a division of Exxon Corporation (hereinafter "Exxon") operates a petroleum refinery in the City of Linden known as the Bayway Refinery.

2. Since the inception of the Refinery in 1909, Exxon has discharged its once through cooling water pumped in from the Arthur Kill into Morses Creek, a small tidal inlet located almost entirely within the confines of the Bayway Refinery.

3. The discharge of the once through cooling water, together with treated process water and storm water runoff into Morses Creek is regulated by the Department of Environmental Protection ("DEP") through its NJPDES program under NJPDES Permit No. NJ0001511.

4. Permit No. NJ000511 expired in 1988 and the Bayway Refinery is currently operating under its terms and conditions as a Permit by Rule pursuant to <u>N.J.A.C. 7:13A-1.9</u> and <u>2.3</u>.

5. On December 3,1990, the DEP informed Exxon of its decision affirming the SE-3 classification for Morses Creek and denying Exxon's conditional application for reclassification.

6. In the letter informing Exxon of its decision, the DEP announced its intention to issue a draft renewal permit for Exxon's discharge which would incorporate more stringent water quality based effluent limitations necessary to achieve the designated water quality standards in Morses Creek. In the documentatio

which accompanied the letter, the DEP stated that the thermal limitations in Exxon's current NJPDES Permit are less stringent than required to meet the criterion for SE-3 waters.

7. Exxon's discharges into Morses Creek are currently meeting the effluent limitations of its Permit which are those required by Sections 301(b) and 306 of the Federal Clean Water Act. P.L. 92-500, 33 U.S.C. 1251, et. seq. and are as stringent as the best available technology economically achievable as provided in that Federal Act.

8. N.J.S. 58:10A-8 provides:

> "Whenever the commissioner finds that discharges from a point source or a group of point sources with the application of the effluent limitations authorized in this act, which effluent limitations are as stringent as the best available technology economically achievable as provided for in the Federal Act or State law, would interfere with the attainment and maintenance of applicable water quality standards, the commissioner may establish more stringent effluent limitations for each such point source or group of point sources, which effluent limitations can reasonably be expected to contribute to the attainment and maintenance of the applicable water quality standards. Prior to the establishment of any more stringent effluent limitations under this section, the commissioner shall publish a notice of his intent to establish such limitations and, upon request of a person affected by any such limitations, the commissioner shall hold a public hearing to determine if there is a reasonable relationship between the economic and social costs of achieving such limitations, including any economic or social dislocation in the affected community or communities, and the social and environmental benefits to be obtained, including the objective of restoring and maintaining the water quality of the State, and to determine whether such effluent limitations can be implemented with available technology or with other control strategies. If a person

> affected by any such limitations demonstrates at the hearing that there is no reasonable relationship between the economic and social costs of compliance and the benefits to be obtained, the commissioner shall modify any such limitations as they may apply to that person."

9. Exxon is a person affected by the more stringent limitations which the DEP intends to establish for the discharges into Morses Creek.

10. In the course of the hearing held in January, 1990 by the DEP on Exxon's challenge to the SE-3 Classification of Morses Creek and the conditional application for reclassification, Exxon demonstrated that (1) there is no environmental benefit to the attempt to attain these water quality standards in Morses Creek if these more stringent effluent limitations are established; (2) there is no available technology that would permit Exxon to continue its discharges into Morses Creek; (3) the cost of removal of Exxon's discharge would be in excess of 100 million dollars; and (4) imposition of these limitations could result in cessation of refining operations at Bayway which would have widespread adverse social and economic impacts.

WHEREFORE, Exxon requests that you hold a public hearing to determine:

1. If there is a reasonable relationship between the economic and social costs of achieving more stringent effluent limitations for Exxon's discharges into Morses Creek, including any economic or social dislocation in the affected community or communities, and the social and environmental benefits to be obtained therefrom; and

2. Whether such effluent limitations can be implemented

with available technology or with other control strategies.

Respectfully submitted,

EXXON COMPANY, U.S.A.

By Dwight Wiggins

Dwight Wiggins
Manager, Bayway Refinery

State of New Jersey
DEPARTMENT OF ENVIRONMENTAL PROTECTION
DIVISION OF WATER RESOURCES
P. O. BOX CN-029
TRENTON, NEW JERSEY 08625

ARNOLD SCHIFFMAN
DIRECTOR

Mr. David J. Mahoney, Jr.
Senior Counsel
Exxon Company, U.S.A.
P.O. Box 222
Linden, New Jersey 07036

JUL 23 1980

Re: Water Quality Standard
for Tidal Portion of Morses Creek

Dear Mr. Mahoney:

This is in response to your letter of June 27, 1980 in which you requested that the Department conduct a separate hearing concerning the water quality standard for the tidal portion of Morses Creek, Linden.

Your request for a hearing is hereby granted. We have received your presentation on the thermal effect of Exxon's discharge on the Arthur Kill. May we suggest that a copy of that report be forwarded to Mr. Conrad Simon at EPA Region II, if you have not already done so.

At this time we are unable to provide any further information concerning the hearing, however, we will be communicating with you again on this subject in the very near future. It is our understanding, also, that the present status will be maintained as to the regulation of Exxon's discharge until the water quality standard issue is resolved.

Sincerely yours,

Douglas M. Clark

Douglas M. Clark
Assistant Director
Monitoring and Planning Element

BMG:DMC:aj

<u>Section 302 (33 U.S.C. 1312) prior to 1987</u>

"Whenever, in the judgment of the Administrator, discharges of pollutants from a point source or group of point sources, with the application of effluent limitations required under Section 1311(b)(2) of this title, would interfere with the attainment or maintenance of that water quality in the specific portion of the navigable waters which shall assure protection of public water supplies, agricultural and industrial uses, and the protection and propagation of a balanced population of shellfish, fish and wildlife, and allow recreational activities in and on the water, effluent limitations (including alternative effluent control strategies) for such point source or sources shall be established which can reasonably be expected to contribute to the attainment or maintenance of such water quality.

(b) Notice; hearing, adjustment of limitation by Administrator

(1) Prior to establishment of any effluent limitation pursuant to subsection (a) of this section, the Administrator shall issue notice of intent to establish such limitation and within ninety days of such notice hold a public hearing to determine the relationship of the economic and social costs of achieving any such limitation or limitations, including any economic or social dislocation in the effected community or communities, to the social and economic benefits to be obtained (including the attainment of the objective of this chapter) and to determine whether or not such effluent limitations can be implemented with available technology or other alternative control strategies.

(2) If a person affected by such limitation demonstrates at such hearing that (whether or not such technology or other alternative control strategies are available) there is no reasonable relationship between the economic and social costs and the benefits to be obtained (including attainment of the objective of this chapter), such limitation shall not become effective and the

Administrator shall adjust such limitation as it applies to such person."

<u>Section 302 - As presently constituted.</u>

Section 1312. Water quality related effluent limitations.

(a) Establishment.

Whenever, in the judgment of the Administrator or as identified under Section 1314(l) of this title, discharges of pollutants from a point source or group of point sources, with the application of effluent limitations required under Section 1311(b)(2) of this title, would interfere with the attainment or maintenance of that water quality in a specific portion of the navigable waters which shall assure protection of public health, public water supplies, agricultural and industrial uses, and the protection and propagation of a balanced population of shellfish, fish and wildlife, and allow recreational activities in and on the water, effluent limitations (including alternative effluent control strategies) for such point source or sources shall be established which can reasonably be expected to contribute to the attainment or maintenance of such water quality.

(b) Modifications of effluent limitations

(1) Notice and hearing

Prior to establishment of any effluent limitation pursuant to subsection (a) of this section, the Administrator shall publish such proposed limitation and within 90 days of such publication hold a public hearing.

(2) Permits

(A) No reasonable relationship

The Administrator, with the concurrence of the State, may issue a permit which modifies the effluent limitations required by subsection (a) of this section for pollutants other than toxic pollutants if the applicant demonstrates at such hearing that (whether or not technology or other alternative control strategies are available) there is no reasonable relationship between the economic and social costs and the benefits to be obtained (including attainment of the objective of this chapter) from achieving such limitation.

(B) Reasonable progress

The Administrator, with the concurrence of the State, may issue a permit which modifies the effluent limitations required by subsection (a) of this section for toxic pollutants for a single period not to exceed 5 years if the applicant demonstrates to the satisfaction of the Administrator that such modified requirements (i) will represent the maximum degree of control within the economic capability of the owner and operator of the source, and (ii) will result in reasonable further progress beyond the requirements of section 1311(b)(2) of this section toward the requirements of subsection (a) of this section.

NEW JERSEY STATE DEPARTMENT OF ENVIRONMENTAL PROTECTION
DIVISION OF WATER RESOURCES
BUREAU OF WATER QUALITY STANDARDS AND ANALYSIS
PLANNING & STANDARDS ELEMENT

304 (1)(1)B Final Short List Reaches

ID (Reach) #	Waterbody Name & Description
02030104003	**Arthur Kill** From the confluence of the Rahway River to the confluence with the Raritan River/Bay. (7.95mi).
02030103001	**Hackensack River** From the Oradell Reservoir to the confluence with Newark Bay. (22.25mi).
0204015013	**Pequest River (Lower)** From the confluence with Bear Creek to the confluence with the Delaware River (18.18mi).
02030104005	**Raritan Bay** From the confluence of the Arthur Kill/Raritan River to the confluence with the Waackaack Creek (10.68mi).
02030104001	**Upper New York Bay** From the confluence of the East River to the confluence with the Kill Van Kull (3.67mi).
02030104002	**Newark Bay/Arthur Kill/Kill Van Kull** From the confluence of the Passaic and Hackensack Rivers to the confluence of the Rahway River and to the confluence with Upper New York Bay.
02040202004	**Raccoon Creek** Entire Reach, from the headwaters to the confluence with the Delaware River.
02030103025	**Passaic River** From the confluence at the Dead River to the confluence with the Whipppany River (26.0mi).
02030104016*	**Kings Creek** Entire segment, from the headwaters to the confluence with the Rahway River.

*This [illegible] does not have an individual identifying reach wastewater may be waived regardless of flow.

(8) "Class I sludge management facilities" as defined in 40 CFR 501.2.

[123.24(d)(8) added by 54 FR 18780. May 2. 1989]

(e) Whenever a waiver is granted under paragraph (d) of this section, the Memorandum of Agreement shall contain:

(1) A statement that the Regional Administrator retains the right to terminate the waiver as to future permit actions, in whole or in part, at any time by sending the State Director written notice of termination: and

(2) A statement that the State shall supply EPA with copies of final permits.

§ 123.25 Requirements for permitting.

(a) All State Programs under this Part must have legal authority to implement each of the following provisions and must be administered in conformance with each, except that a State which chooses not to administer a sludge management program pursuant to section 405(f) of the CWA as part of its NPDES program is not required to have legal authority to implement the portions of the following provisions which were promulgated after the enactment of the Water Quality Act of 1987 (Pub. L. 100-4) and which govern sewage sludge use and disposal. In all cases, States are not precluded from omitting or modifying any provisions to impose more stringent requirements:

[123.25(a) revised by 54 FR 18780. May 2. 1989]

(1) § 122.4—(Prohibitions):

[123.25(a)(1) corrected by 50 FR 6940. February 19. 1985; 50 FR 7912. February 27. 1985]

(2) § 122.6(a) and (b)—(Effect of permit);

(3) §122.7(b) and (c) — (Confidential information);

[123.25(a)(3) corrected by 50 FR 6940, February 19, 1985]

(4) § 122.21(a)-(b), (e)-(j), and (l)-(o)—(Application for a permit);

(5) § 122.22—(Signatories);

(6) § 122.23—(Concentrated animal feeding operations);

(7) § 122.24—(Concentrated aquatic animal production facilities);

(8) § 122.25—(Aquaculture projects);

(9) § 122.26—(Separate storm sewers);

(10) § 122.27—(Silviculture);

(11) § 122.28—(General permits), *provided that* States which do not seek to implement the general permit program under § 122.28 need not do so.

(12) § 122.41—(Applicable permit conditions);

(13) § 122.42—(Conditions applicable to specified categories of permits);

(14) § 122.43—(Establishing permit conditions);

(15) § 122.44—(Establishing NPDES permit conditions);

(16) § 122.45—(Calculating permit conditions);

(17) § 122.46—(Duration);

(18) § 122.47(a)—(Schedules of compliance);

(19) § 122.48—(Monitoring requirements);

(20) § 122.50—(Disposal into wells);

(21) § 122.61—(Permit transfer);

(22) § 122.62—(Permit modification);

(23) § 122.64—(Permit termination);

(24) § 124.3(a)—(Application for a permit);

(25) § 124.5 (a), (c), (d), and (f)—(Modification of permits);

(26) § 124.6 (a), (c), (d), and (e)—(Draft permit);

(27) § 124.8—(Fact sheets);

(28) § 124.10 (a)(1)(ii), (a)(1)(iii), (a)(1)(v), (b), (c), (d), and (e)—(Public notice);

(29) § 124.11—(Public comments and requests for hearings);

(30) § 124.12(a)—(Public hearings); and

(31) § 124.17 (a) and (c)—(Response to comments);

(32) § 124.56—(Fact sheets);

(33) § 124.57(a)—(Public notice);

(34) § 124.59—(Comments from government agencies);

(35) § 124.62—(Decision on variances);

(36) Subparts A, B,C, D, H, I, J, K and L of Part 125; and

(37) 40 CFR Parts 129, 133, Subchapter N and 40 CFR Part 503.

[123.25(a)(37) amended by 54 FR 18780. May 2. 1989]

NOTE: States need not implement provisions identical to the above listed provisions. Implemented provisions must, however, establish requirements at least as stringent as the corresponding listed provisions. While States may impose more stringent requirements, they may not make one requirement more lenient as a tradeoff for making another requirement more stringent; for example, by requiring that public hearings be held prior to issuing any permit while reducing the amount of advance notice of such a hearing.

State programs may, if they have adequate legal authority, implement any of the provisions of Parts 122 and 124. See, for example, § 122.5(d) (continuation of permits) and § 124.4 (consolidation of permit processing).

For example, a State may impose more stringent requirements in an NPDES program by omitting the upset provision of § 122.41 or by requiring more prompt notice of an upset.

(b) State NPDES programs shall have an approved continuing planning process under 40 CFR 35.1500 and shall assure that the approved planning process is at all times consistent with CWA.

(c) State NPDES programs shall ensure that any board or body which approves all or portions of permits shall not include as a member any person who receives, or has during the previous 2 years received, a significant portion of income directly or indirectly from permit holders or applicants for a permit.

(1) For the purposes of this paragraph:

(i) "Board or body" includes any individual, including the Director, who has or shares authority to approve all or portions of permits either in the first instance, as modified or reissued, or on appeal.

(ii) "Significant portion of income" means 10 percent or more of gross personal income for a calendar year, except that it means 50 percent or more of gross personal income for a calendar year if the recipient is over 60 years of age and is receiving that portion under retirement, pension, or similar arrangement.

(iii) "Permit holders or applicants for a permit" does not include any department or agency of a State government, such as a Department of Parks or a Department of Fish and Wildlife.

(iv) "Income" includes retirement benefits, consultant fees, and stock dividends.

(2) For the purposes of paragraph (c) of this section, income is not received "directly or indirectly from permit holders or applicants for a permit" when it is derived from mutual fund payments, or from other diversified investments for which the recipient does not know the identity of the primary sources of income.

§ 123.26 Requirements for compliance evaluation programs.

(a) State programs shall have procedures for receipt, evaluation, retention and investigation for possible enforcement of all notices and reports required of permittees and other regulated persons (and for investigation for possible enforcement of failure to submit these notices and reports).

(b) State programs shall have inspection and surveillance procedures to determine, independent of information supplied by regulated persons, compliance or noncompliance with applicable program requirements. The State shall maintain:

(1) A program which is capable of making comprehensive surveys of all facilities and activities subject to the State Director's authority to identify persons subject to regulation who have failed to comply with permit application or other program requirements. Any compilation, index or inventory of such facilities and activities shall be made available to the Regional Administrator upon request;

STATES WITH INDUSTRIAL USE CLASSIFICATION	STATES WITHOUT INDUSTRIAL USE CLASSIFICATION
1. **Alabama** [1] BNA 701:1009 Section VI F - Industrial Operations	1. **Arizona**
2. **Alaska** BNA 706:1001 18 AAC.70.020	2. **Colorado** BNA 726:0105 Has Qualifiers - use can be designated as "Goal" with temporary modifications
3. **Arkansas** BNA 716:1004 Section 4 (c)(3)(h)	3. **Connecticut** BNA 731:1013 Class D - Present conditions preclude one or more designated uses Class SD
4. **California** EPA 440/5-88/008, p. 11 California Water Quality Standards by River Basins CA. 1975	4. **Delaware** Has Industrial Water Supply Use but no stream is classified for just this.
5. **District of Columbia** BNA 741:1001 Class E Waters Industrial Water Supply Section 1101.1(e)	5. **Hawaii**
6. **Florida** BNA 746:1016. Class V Navigation Utility and Industrial Use. Section 17-3.081	6. **Illinois** BNA 766:0514 Water not designated for Public Water Supply Thermal Discharge Site specific. Section 303.500
7. **Georgia** BNA 751:0504; BNA 751:0508	7. **Iowa**

[1] Reference is to Environmental Reporter, Bureau of National Affairs, Inc.

Industrial
Sections 391-3-6-.03(4)(e);
391-3-6-.03(6)(e)

8. **Idaho**
BNA 761:1004.2
Industrial Water Supplies
Private Waters
Section 01.2101(02)

9. **Indiana**
BNA 771:1002
327 IAC 2-1-3
Section 3(a)(3)
Industrial Water Supply
Also limited water use

10. **Kansas**
BNA 781:1003
28-16-28d-(a)(2)(C)(5)
Industrial Water Supply use.

11. **Minnesota**
BNA 816:1004
Water Use Classification
3. Industrial consumption
Section 7050.0200(3);
Section 7050.0210 (Sup. p.6)

12. **Missouri**
BNA 826:1001
10. Industrial process and
cooling water
10 CSR 20-7.031(1)(C)(10)

13. **Nebraska**
BNA 836:1019
Industrial
Section 004.03

14. **Nevada**
BNA 841:1011
Class D Waters
Section 445.125

15. **New Hampshire**
BNA 846:0104
Class C Waters suitable
for industrial purposes,
power and navigation
Section 485-A:8 (III)

8. **Kentucky**
BNA 786:1018
Grants exceptions to
criteria for water
quality
401 KAR 5:031 Sec. 9

9. **Maine**

10. **New Jersey**

11. **Maryland**

12. **Massachusetts**

13. **Michigan**

14. **Mississippi**
BNA 821:1004
Ephemeral stream
exceptions to
limits; Sec. III.5
BNA 821:1003

15. **Montana**
BNA 831:1002
Exception - water
bodies used solely
for treating,
transporting or

impounding pollutants shall not be considered surface waters.
Section 16.20.603(23)

16. **New Mexico**
BNA 856:1001
Industrial supply - not permitted to lower below recreation and fishing where practicable
Section 1-100 (B)

16. **New York**
Class SD BNA 861-1010
All waters not primarily for recreational purposes, shellfish, culture or development of fish life and because of natural or man made conditions cannot meet the requirements of these uses.

17. **North Dakota**
BNA 871:1002
Industrial water
Section 33-16-02-04(2)
BNA 871:1005
Class III streams
Section 33-16-02-08

17. **North Carolina**
BNA 866:1017
.0215 Effluent Channels. The standards of water quality contained in this section shall not apply to waters within effluent channels, etc.

18. **Ohio**
BNA 876:1001
Industrial- 3745-1-01(D)
See also Nuisance Prevention. BNA 876:1005
Section 3745-1-07(B)

18. **South Carolina**
BNA 906:1006
Numeric Standards for specific waters may be established by the Department to replace numeric standards of Sections D and E. Establishment of such standards shall be subject to public participation and administrative procedures for adopting regulations.

19. **Oklahoma**
BNA 881:1008
Industrial and Municipal

19. **Texas**
BNA 921:1003
Numerical temperature

Section 300.10
Process and Cooling Water;
also BNA 881:1004
Section 100.6(B)
Waters of the State
excludes privately
owned reservoirs used in
process of cooling
water for industrial purposes

criteria have not been
specifically
established for
cooling lake
impoundments which
in most areas of the
State contribute to
water conservation
and water quality
objectives.
Intermittent streams
unclassified uses
include industrial raw
water supply.
Section 307.4(f)

20. **Oregon**
BNA 886:1059
Industrial Water Supply

21. **Pennsylvania**
BNA 891:1025
Industrial Water Supply

22. **Rhode Island**
BNA 901:1001 - Industrial
6.21 Class E

23. **South Dakota**
BNA 911:1001
Commerce and Industry
waters.
74:03:02:01(10)
BNA 911:1005
74:03:02:30(11)

24. **Tennessee**
BNA 916:0541
Water supply for domestic
and industrial purposes.
Section 1200-4-3-.02(2)

25. **Utah**

20. **Vermont**
BNA 931:1004
Does have unregulated
waters.
Section 2-02(A)

21. **Virginia**

22. **Washington**
BNA 941:1009
(1) Includes
industrial
water supply as a use
(2) has provision to
control miscellaneous
water discharges
Section WAC 173-201-
100

23. **Wisconsin**
BNA 951:1011
Has provision
variance in effluent
limitations for
wastewater effluent
channels and discharge
ditches
Section NR 104.02(3)
3 a-c

BNA 926:1002
Class 5 - protected for
industrial uses, including
cooling, boiler make up.
Section 2.6.5

26. **West Virginia**
BNA 946:1003
Category E - Water
supply industrial cooling
and power
Section 46-1-6.6 (Category E)

27. **Wyoming**
BNA 956:1005,
BNA 956:1002 - Industry
Section 3
BNA 956:1003
Class IV waters which
do not have potential
to support fish
BNA 956:1005
Section 19
Industrial Water Supply

Federal EPA 40 C.F.R. Section 122.2 excludes waste treatment systems from definition of waters of United States (limitation as to man-made bodies has been suspended.

EPA Blue Book (copy attached) - Discharge Canal (applies to canals or embayments).

able sequence of interim requirements (for example, actions, operations, or milestone events) leading to compliance with the CWA and regulations.

Secondary industry category means any industry category which is not a "primary industry category."

Secretary means the Secretary of the Army, acting through the Chief of Engineers.

Septage means the liquid and solid material pumped from a septic tank, cesspool, or similar domestic sewage treatment system, or a holding tank when the system is cleaned or maintained.

[Added by 54 FR 18780, May 2, 1989]

Sewage from vessels means human body wastes and the wastes from toilets and other receptacles intended to receive or retain body wastes that are discharged from vessels and regulated under section 312 of CWA, except that with respect to commercial vessels on the Great Lakes this term includes graywater. For the purposes of this definition, "graywater" means galley, bath, and shower water.

Sewage Sludge means any solid, semi-solid, or liquid residue removed during the treatment of municipal waste water or domestic sewage. Sewage sludge includes, but is not limited to, solids removed during primary, secondary, or advanced waste water treatment, scum, septage, portable toilet pumpings, type III marine sanitation device pumpings (33 CFR Part 159), and sewage sludge products. Sewage sludge does not include grit or screenings, or ash generated during the incineration of sewage sludge.

[Added by 54 FR 18780, May 2, 1989]

Sewage sludge use or disposal practice means the collection, storage, treatment, transportation, processing, monitoring, use, or disposal of sewage sludge.

[Added by 54 FR 18780, May 2, 1989]

Site means the land or water area where any "facility or activity" is physically located or conducted, including adjacent land used in connection with the facility or activity.

Sludge-only facility means any "treatment works treating domestic sewage" whose methods of sewage sludge use or disposal are subject to regulations promulgated pursuant to section 405(d) of the CWA, and is required to obtain a permit under §122.1(b)(3) of this Part.

[Added by 54 FR 18780, May 2, 1989]

Standards for sewage sludge use or disposal means the regulations promulgated pursuant to section 405(d) of the CWA which govern minimum requirements for sludge quality, management practices, and monitoring and reporting applicable to sewage sludge or the use or disposal of sewage sludge by any person.

[Added by 54 FR 18780, May 2, 1989]

State means any of the 50 States, the District of Columbia, Guam, the Commonwealth of Puerto Rico, the Virgin Islands, American Samoa, the Commonwealth of the Northern Mariana Islands, and the Trust Territory of the Pacific Islands.

[Amended by 54 FR 254, January 4, 1989]

State Director means the chief administrative officer of any State or interstate agency operating an "approved program," or the delegated representative of the State Director. If responsibility is divided among two or more State or interstate agencies, "State Director" means the chief administrative officer of the State or interstate agency authorized to perform the particular procedure or function to which reference is made.

State/EPA Agreement means an agreement between the Regional Administrator and the State which coordinates EPA and State activities, responsibilities and programs including those under the CWA programs.

Total dissolved solids means the total dissolved (filterable) solids as determined by use of the method specified in 40 CFR Part 136.

Toxic pollutant means any pollutant listed as toxic under section 307(a)(1) of CWA.

Toxic pollutant means any pollutant listed as toxic under section 307(a)(1) or, in the case of "sludge use or disposal practices," any pollutant identified in regulations implementing section 405(d) of the CWA.

[Added by 54 FR 18780, May 2, 1989]

Treatment works treating domestic sewage means a POTW or any other sewage sludge or waste water treatment devices or systems, regardless of ownership (including federal facilities), used in the storage, treatment, recycling, and reclamation of municipal or domestic sewage, including land dedicated for the disposal of sewage sludge. This definition does not include septic tanks or similar devices. For purposes of this definition, "domestic sewage" includes waste and waste water from humans or household operations that are discharged to or otherwise enter a treatment works. In States where there is no approved State sludge management program under section 405(f) of the CWA, the Regional Administrator may designate any person subject to the standards for sewage sludge use and disposal in 40 CFR Part 503 as a "treatment works treating domestic sewage," where he or she finds that there is a potential for adverse effects on public health and the environment from poor sludge quality or poor sludge handling, use or disposal practices, or where he or she finds that such designation is necessary to ensure that such person is in compliance with 40 CFR Part 503.

[Added by 54 FR 18780, May 2, 1989]

Variance means any mechanism or provision under section 301 or 316 of CWA or under 40 CFR Part 125, or in the applicable "effluent limitations guidelines" which allows modification to or waiver of the generally applicable effluent limitation requirements or time deadlines of CWA. This includes provisions which allow the establishment of alternative limitations based on fundamentally different factors or on sections 301(c), 301(g), 301(h), 301(i), or 316(a) of CWA.

Waters of the United States or *waters of the U.S.* means:

(a) All waters which are currently used, were used in the past, or may be susceptible to use in interstate or foreign commerce, including all waters which are subject to the ebb and flow of the tide;

(b) All interstate waters, including interstate "wetlands;"

(c) All other waters such as intrastate lakes, rivers, streams (including intermittent streams), mudflats, sandflats, "wetlands," sloughs, prairie potholes, wet meadows, playa lakes, or natural ponds the use, degradation, or destruction of which would affect or could affect interstate or foreign commerce including any such waters:

(1) Which are or could be used by interstate or foreign travelers for recreational or other purposes;

(2) From which fish or shellfish are or could be taken and sold in interstate or foreign commerce; or

(3) Which are used or could be used for industrial purposes by industries in interstate commerce;

(d) All impoundments of waters otherwise defined as waters of the United States under this definition;

(e) Tributaries of waters identified in paragraphs (a) through (d) of this definition;

(f) The territorial sea; and

(g) "Wetlands" adjacent to waters (other than waters that are themselves wetlands) identified in paragraphs (a) through (f) of this definition.

Waste treatment systems, including treatment ponds or lagoons designed to meet the requirements of CWA (other than cooling ponds as defined in 40 CFR 423.11(m) which also meet the criteria of this definition) are not waters of the United States. This exclusion applies only to manmade bodies of water which neither were originally created in waters of the United States (such as disposal area in wetlands) nor resulted from the impoundment of waters of the United States. [See Note 1 of this section.]

Wetlands means those areas that are inundated or saturated by surface or groundwater at a frequency and duration sufficient to support, and that under normal circumstances do support, a prevalence of vegetation typically adapted for life in saturated soil conditions. Wetlands generally include swamps, marshes, bogs, and similar areas.

Whole effluent toxicity **means the aggregate toxic effect of an effluent measured directly by a toxicity test.**

[Added by 54 FR 23895, June 2, 1989]

NOTE: At 45 FR 48620, July 21, 1980, the Environmental Protection Agency suspended until further notice in § 122.2, the last sentence, beginning "This exclusion applies . . ." in the definition of "Waters of the United States." This revision continues that suspension.[1]

§ 122.3 **Exclusions.**

The following discharges do not require NPDES permits:

(a) Any discharge of sewage from vessels, effluent from properly functioning marine engines, laundry, shower, and galley sink wastes, or any other discharge incidental to the normal operation of a vessel. This exclusion does not apply to rubbish, trash, garbage, or other such materials discharged overboard; nor to other discharges when the vessel is operating in a capacity other than as a means of transportation such as when used as an energy or mining facility, a storage facility or a seafood processing facility, or when secured to a storage facility or a seafood processing facility, or when secured to the bed of the ocean, contiguous zone or waters of the United States for the purpose of mineral or oil exploration or development.

(b) Discharges of dredged or fill material into waters of the United States which are regulated under section 404 of CWA.

(c) The introduction of sewage, industrial wastes or other pollutants into publicly owned treatment works by indirect dischargers. Plans or agreements to switch to this method of disposal in the future do not relieve dischargers of the obligation to have and comply with permits until all discharges of pollutants to waters of the United States are eliminated. (See also § 122.47(b)). This exclusion does not apply to the introduction of pollutants to privately owned treatment works or to other discharges through pipes, sewers, or other conveyances owned by a State, municipality, or other party not leading to treatment works.

(d) Any discharge in compliance with the instructions of an On-Scene Coordinator pursuant to 40 CFR Part 1510 (The National Oil and Hazardous Substances Pollution Plan) or 33 CFR 153.10(e) (Pollution by Oil and Hazardous Substances).

[122.3(d) amended by 54 FR 254, January 4, 1989]

(e) Any introduction of pollutants from non point-source agricultural and silvicultural activities, including storm water run-off from orchards, cultivated crops, pastures, range lands, and forest lands, but not discharges from concentrated animal feeding operations as defined in §122.23, discharges from concentrated aquatic animal production facilities as defined in §122.24, discharges to aquaculture projects as defined in §122.25, and discharges from silvicultural point sources as defined in §122.27.

[122.3(e) amended by 54 FR 254, January 4, 1989]

(f) Return flows from irrigated agriculture.

(g) Discharges into a privately owned treatment works, except as the Director may otherwise require under § 122.44(m).

§ 122.4 **Prohibitions (applicable to State NPDES programs, see § 123.25).**

No permit may be issued:

(a) When the conditions of the permit do not provide for compliance with the applicable requirements of CWA, or regulations promulgated under CWA;

(b) When the applicant is required to obtain a State or other appropriate certification under section 401 of CWA and § 124.53 and that certification has not been obtained or waived;

(c) By the State Director where the Regional Administrator has objected to issuance of the permit under § 123.44;

(d) When the imposition of conditions cannot ensure compliance with the applicable water quality requirements of all affected States;

(e) When, in the judgment of the Secretary, anchorage and navigation in or on any of the waters of the United States would be substantially impaired by the discharge;

(f) For the discharge of any radiological, chemical, or biological warfare agent or high-level radioactive waste;

(g) For any discharge inconsistent with a plan or plan amendment approved under section 208(b) of CWA;

(h) For any discharge to the territorial sea, the waters of the contiguous zone, or the oceans in the following circumstances:

(1) Before the promulgation of guidelines under section 403(c) of CWA (for determining degradation of the waters of the territorial seas, the contiguous zone, and the oceans)

[1] Editorial Note: The words "This revision" refer to the document published at 48 FR 14153, Apr. 1, 1983.

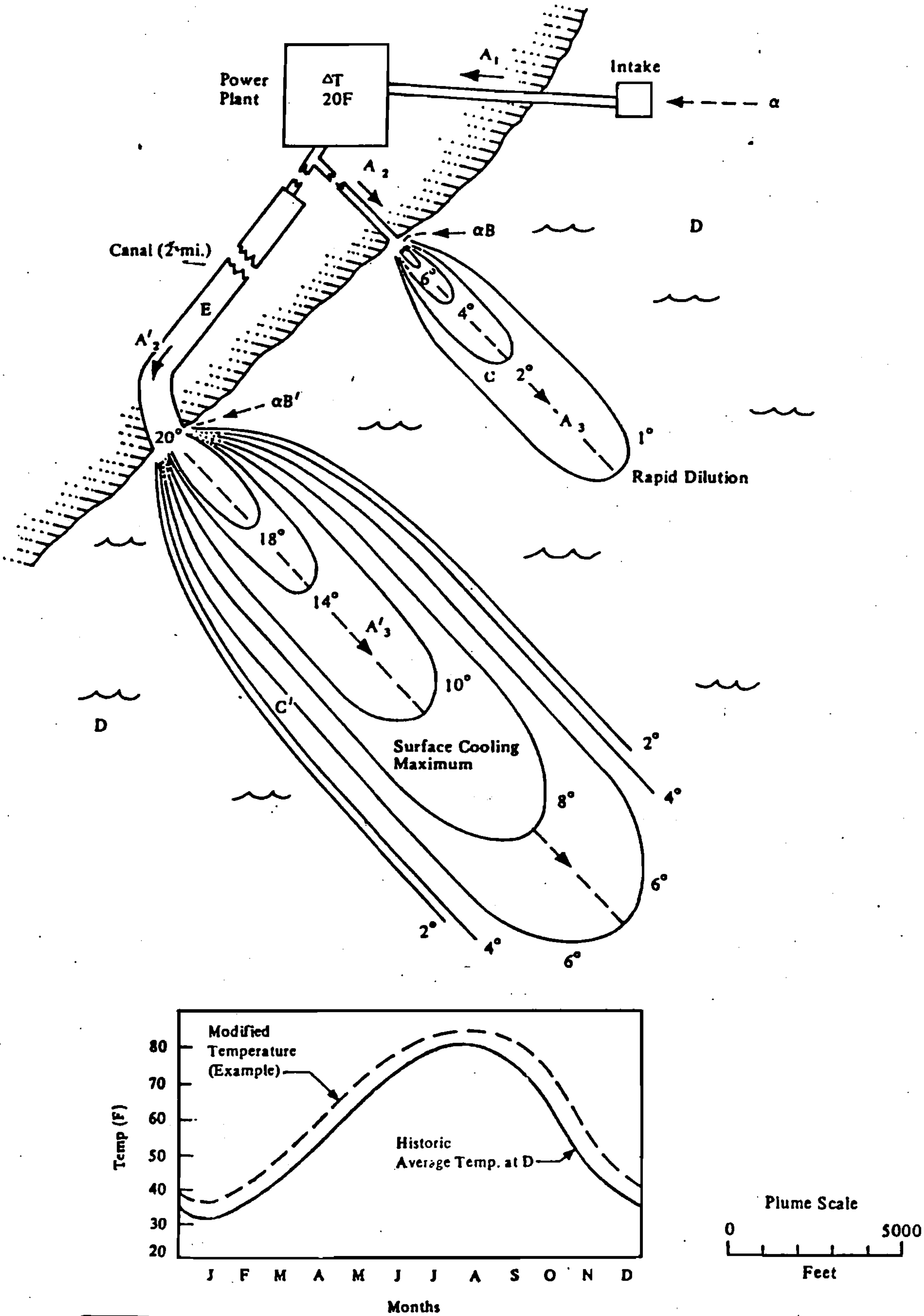


FIGURE III-7—Hypothetical Power Plant Site For Application of Water Temperature Criteria charges should be located so that zones important for reproduction—migration, spawning, incubation—are not used.

Criteria for species diversity provide a useful tool for identifying effects of thermal changes after they have occurred, particularly the effects of subtle changes that are a result of community interactions rather than physiological responses by one or more major species. Further research may identify critical temperatures or sequences of temperature changes that cannot be exceeded and may thereby provide a predictive capability as well. (See Appendix II–B.)

Mixed Water Body (or major region thereof)

This is the region most commonly considered in establishing water quality standards, for it generally includes the major area of the water body. Here the results of thermal additions are observed as small temperature increases over a large area (instead of high temperatures locally at the discharge point), and all heat sources become integrated into the normal annual temperature cycle (Figure III–6 and Figure III–7 insert).

Detrimental high temperatures in this area (or parts of it) are defined by the criteria for maximum temperatures for prolonged exposure (warm and cool months) for the most sensitive species or life stage occurring there, at each time of year, and by the criteria for reproduction.

For example, in the lake with the hypothetical power station, there may be 40 principal fish species, of which half are considered important. These species have spawning temperatures ranging from 5 to 6 C for the sauger (*Stizostedion canadense*) to 26.7 C for the spotted bullhead (*Ictalurus serracanthus*). They also have a similar range of temperatures required for egg incubation, and a range of maximum temperatures for prolonged exposures of juveniles and adults. The requirements, however, may be met any time within normal time spans, such as January 1 to 24 for sauger spawning, and March 25 to April 29 for smallmouth bass spawning. Maximum temperatures for prolonged exposures may increase steadily throughout a spring period. To predict effects of thermal discharges the pertinent temperatures for reproductive activities and maximum temperatures for each life stage can be plotted over a 12-month period such as shown in Fig. III–6. A maximum annual temperature curve can become apparent when sufficient biological data are available. Mount (1970)[306] gives an example of this type of analysis.

Discharge Canal

Canals or embayments that carry nearly undiluted condenser cooling water can develop biological communities that are atypical of normal seasonal communities. Interest in these areas does not generally derive from concern for a balanced ecosystem, but rather from effects that the altered communities can have on the entire aquatic ecosystem.

The general criteria for nuisance organisms may be applicable. In the discharge canals of some existing power stations, extensive mats of temperature-tolerant blue-green algae grow and periodically break away, adding a decomposing organic matter to the nearby shorelines.

The winter criterion for maximum temperatures for prolonged exposures identifies the potential for fish kills due to rapid decreases in temperature. During cold seasons particularly, fish are attracted to warmer water of an enclosed area, such as a discharge canal. Large numbers may reside there for sufficiently long periods to become metabolically acclimated to the warm water. For any acclimation temperature there is a minimum temperature to which the species can be cooled rapidly and still survive (lower incipient lethal temperature). These numerical combinations, where data are available, are found in Appendix II–C. There would be 50 per cent mortality, for example, if largemouth bass acclimated in a discharge canal to 20 C, were cooled to 5.5 C or below. If normal winter ambient temperature is less than 5.5 C, then the winter maximum should be below 20 C, perhaps nearer 15 C. If it is difficult to maintain the lower temperatures, fish should be excluded from the area.

WATER USE CLASSIFICATION

MORSES CREEK

EXXON BAYWAY REFINERY

HISTORY

- MORSES CREEK SMALL TIDAL INLET FROM THE ARTHUR KILL.
- HAS BEEN USED BY EXXON'S BAYWAY REFINERY SINCE 1909 FOR RETURN OF COOLING WATER AND DISCHARGE OF TREATED PROCESS WATER.
- COOLING AND PROCESS WATER CONSTITUTES OVER 99% OF DRY WEATHER FLOW. between the dams
- NINETY PERCENT OF THIS FLOW IS THE COOLING WATER WHICH COMES FROM THE ARTHUR KILL, WHICH IS A 304(1) SHORT LIST BODY.
- THERE ARE PRESENTLY TWO DAMS ON MORSES CREEK. NO. 2 DAM UPSTREAM IMPOUNDS FRESH WATER FOR USE IN BAYWAY'S PROCESS EQUIPMENT. NO. 1 DAM IS LOCATED DOWN STREAM CLOSE TO THE ARTHUR KILL TO PREVENT TIDAL FLOW INTO THE CREEK.
- THE DAMS WERE CONSTRUCTED IN 1922.
- IN 1927, EXXON PURCHASED FROM THE STATE A GRANT TO THE CREEK BED OF MORSES CREEK.
- IN 1938, MORSES CREEK WAS DECLARED NON-NAVIGABLE BY THE U.S. CORPS. OF ENGINEERS. may be affected by CWA decisions
- ALSO, IN 1938, THE STATE WATER POLICY FORMALLY APPROVED THE TWO DAMS.
- THE CREEK IS AN INTEGRAL PART OF BAYWAY'S WASTE WATER TREATMENT FACILITIES. IN ADDITION TO THE DAMS, TWO BOOMS ARE EMPLACED TO CONTAIN ANY SPILLS WITHIN THE REFINERY. THERE IS ALSO A PUMPING STATION FOR FIRE PROTECTION.

ECOLOGICAL DATA.

- EXXON HAS HAD FISH STUDIES DONE ON MORSES CREEK AND THE ARTHUR KILL FOR FIFTEEN YEARS. ONE WAS JUST COMPLETED THIS SUMMER.

- LIMITED AQUATIC LIFE IN THE CREEK. ONLY FISH IS THE MUMMICHOG -AKA- KILLY.

REGULATORY HISTORY.

- ORIGINAL EPA DRAFT PERMIT IN EARLY 1970'S RECOGNIZED EXXON'S USE BY DESIGNATING THE ARTHUR KILL AS THE RECEIVING WATERS.
- DECEMBER, 1974, N.J.D.E.P. CLASSIFIED TIDAL PORTION OF MORSES CREEK AS TW-3 AND CERTIFIED THE THERMAL LIMITATION AS A CONDITION OF THE PERMIT.
- EXXON PETITIONED NEW JERSEY FOR RELIEF. AFTER AN EXTENSIVE HEARING, NEW JERSEY, IN 1975 RECLASSIFIED MORSES CREEK AS TW-4(A) - INDUSTRIAL USE.
- IN 1976, EPA REGION II APPROVED THIS RECLASSIFICATION.
- IN 1980, AFTER BEING SUED BY PIRG, EPA RESCINDED ITS APPROVAL.
- DEP PROPOSED TO RECLASSIFY MORSES CREEK IN 1980, EXXON WAS GRANTED A HEARING ON THIS PROPOSAL. TO DATE, THIS HEARING HAS NOT BEEN HELD.
- IN 1984 AND 1988, DEP PROPOSED RECLASSIFICATION OF MORSES CREEK. AGAIN, EXXON WAS GRANTED HEARINGS. NONE HAVE BEEN HELD.
- IN 1985, EXXON SUBMITTED A CONDITIONAL APPLICATION FOR RECLASSIFICATION OF MORSES CREEK.

COMPLIANCE WITH REGULATIONS.

- 85 DEGREE F. THERMAL LIMIT IS EFFECTIVELY A DISCHARGE LIMIT.
- CREEK NOW USED FOR OIL CONTAINMENT AND RECOVERY.
- 90% OF FLOW (ARTHUR KILL WATER) DOES NOT MEET STANDARDS. — however this is not naturally occurring
- DILUTION STUDIES ARE MEANINGLESS.
- EPA ALLOWS DESIGNATION AS INDUSTRIAL USE.

HISTORICAL ALTERNATIVE SYSTEMS TO MEET THERMAL LIMIT ONLY.

- 1. ALTERNATE DISCHARGE CANAL DIRECT TO ARTHUR KILL.
- 2. CONVERSION TO RECYCLE COOLING WATER SYSTEM.
- 3. CONVERSION TO AIR COOLING SYSTEM.
- 4. SPRAY COOLING SYSTEM.
- 5. DILUTION BY PUMPING ADDITIONAL ARTHUR KILL WATER.

CURRENT ALTERNATIVE SYSTEMS: TOTAL ABANDONMENT OF MORSES CREEK.

- 1. RETAIN ONE-THROUGH COOLING SYSTEM AND PIPE TO ARTHUR KILL VIA NEW CONCRETE SEPARATORS AND A DIFFUSER SYSTEM.
- 2. USE OF SALT WATER COOLING TOWERS TO REDUCE SIZE OF SEPARATORS.
- 3. MAXIMIZE USE OF AIR-FIN COOLERS WITH FRESH WATER COOLING TOWER.
- COST OF ALTERNATIVES - 75 TO 100 MILLION DOLLARS.

ENVIRONMENTAL IMPACTS OF CURRENT ALTERNATIVES.

- MORSES CREEK.
  + WITH DAMS, CREEK WOULD BECOME A DRY BED.
  + WITHOUT NO. 1 DAM, CREEK BECOMES AN ARTHUR KILL TIDAL WASH.
  + CREEK AREA IS LESS THAN 1% OF ARTHUR KILL ESTUARINE AREA.
- ARTHUR KILL.
  + ALTERNATIVE 1 INCREASES HEAT LOAD ON ARTHUR KILL.
  + POLLUTANT LOAD ON ARTHUR KILL IS SAME OR GREATER.
  + REMOVAL OF NO. 1 DAM INCREASES AMOUNT OF OILY STORM WATER RUNOFF TO ARTHUR KILL.

- OTHER.

  + ALT. 2 ADDS SALT DRIFT AND FOG IMPACTS ON NJ TURNPIKE AND NEWARK AIRPORT APPROACH.

  + ALT. 3 INCREASES ELECTRIC POWER DEMAND AND USES LARGE VOLUMES OF POTABLE WATER.

  + ALT. 2 AND 3 RELEASE ADDITIONAL HEAT DIRECTLY TO ATMOSPHERE IN INDUSTRIALIZED AREA.

CONCLUSION.

- RECLASSIFICATION FOR INDUSTRIAL USE IS APPROPRIATE.

- CREEK REMAINS ON EXXON PROPERTY WITH NO PUBLIC ACCESS.

- NO BENEFICIAL, SOCIAL OR ECOLOGICAL EFFECTS SEEN FROM ELIMINATION OF EXXON'S USE.

- MORSES CREEK IS UNIQUE - NO PRECEDENT WOULD BE ESTABLISHED.

ATTENDEE	POSITION	PHONE NO.
HANK VAN HANDLE	EXXON / ENVIRONMENTAL CNT	201-474-7596
Meredith H. Lavery	NJDEP / Water resources	609 633 7020
STEVEN P. LUBOW	NJDEP/DWR	609-633-7020
William F. Boehle	" / Section Chief - Ind. Permits	609-292-4860
Melissa Wilusz	NJDEP/DWR / Supervisor - Surface Water	609-292-4860
Robert Oberthaler	NJDEP-BIOR-Chief	609-292-4860
James J. Maloney	EXXON Legal	201-474-3525
JOHN I CARLIN	ATTY FOR EXXON	201 377-3550
Bill Taetzsch	Exxon - Env. Coord	201-474-7585

BAYWAY SITE-WIDE
WATER BALANCE

REVISED 8/89

OVERALL BALANCE

Water Sources

	MGD	GPM
Arthur Kill	145.7	101,148
Morses Creek	6.4	4,422
Elizabethtown → Utility Water(1)	3.0	2,111
Rain	5.2	3,619
Feed	<0.05	15
TOTAL	160.3	111,315

Water Discharges

	MGD	GPM
Arthur Kill - via 001	159.0	110,451
Evaporation/Losses/STM to ATM	1.0	675
Linden-Roselle Sewerage Auth.	0.1	60
PSE&G Steam Blowdown	0.2	107
Intentional Wasting	<0.05	17
Products	<0.01	5
TOTAL	160.3	111,315

DETAIL ON WATER SOURCES

Source	Use		MGD	GPM	
Arthur Kill	Process Water		1.9	1,287	
	Once-Through Cooling		143.8	99,861	
		TOTAL	145.7	101,148	
Utility Water	Sanitary Uses		0.09	60	
	Process Water*		1.94	1,349	Note 2
	Steam Generation		0.92	642	
	Cooling Tower Make-Up		0.09	60	
		TOTAL	3.0	2,111	
Morses Creek	Treated Water*		1.14	792	
	Process Water (Raw)		0.18	124	
	Wet Gas Scrubber Make-Up		0.63	438	Note 3
	Cooling Water		2.88	1,998	Note 4
	Steam Generation		1.54	1,070	Note 5
		TOTAL	6.4	4,422	
Rain	Contaminated (Treated)		.56	391	
	Clean - Segregated		4.65	3,228	
		TOTAL	5.2	3,619	
Feed	N/A		<0.05	15	

*Not including steam generation.

DETAIL ON WATER SOURCES

Discharge	Source		MGD	GPM	
#1 Dam (DSN 001)	Cooling Tower Blowdown		<.05	20	
	Once-Through Cooling (Fresh)		2.9	1,998	
	Once-Through Cooling (Salt)		143.8	99,861	
	Treated Waste Water (DSN 002)		7.7	5,344	Note 6
	Clean Rainwater		4.6	3,228	
		TOTAL	159.0	110,451	
Evaporation/Steam Exhaust & Miscellaneous Losses	Steam to ATM		0.5	355	
	Cooling Tower (Fresh)		0.1	40	
	Wet Gas Scrubber		0.4	280	
		TOTAL	1.0	675	
To Public Service Gas & Electric for Steam	Morses Creek Water		0.8	528	
	Utility Water		0.9	642	
		TOTAL	1.7	1,170	Note 7
To Linden-Roselle Sewerage Authority	Sanitary Waste		0.1	60	
Intentional Wasting	BIOX DAF Unit		<0.05	17	
Products	N/A		<0.01	5	

DETAIL ON WATER SOURCES TO WASTE WATER TREATMENT PLANT

Facility	Source		MGD	GPM	
Refinery (includes <1 GPM from offsite company facilities)	Arthur Kill		1.65	1,145	
	Morses Creek - Raw		0.81	562	Note 8
	Morses Creek - Treated		1.14	792	
	Steam		0.77	532	Note 9
	Utility		1.14	792	Note 8
	Feed		0.01	10	Note 10
	Rain		0.38	264	
		SUB-TOTAL	5.9	4,097	
East Side Chem Plant	Arthur Kill		--	--	
	Morses Creek - Raw		--	--	
	Morses Creek - Treated		.02	15	
	Steam		.1	65	Note 9
	Utility		--	--	
	Rain		.06	40	
		SUB-TOTAL	0.2	120	

DETAIL ON WATER SOURCES TO WASTE WATER TREATMENT PLANT (Cont'd.)

Facility	Source		MGD	GPM	
West Side Chem Plant (includes ~7 GPM from Bayonne Plant)	Arthur Kill		0.20	142	
	Morses Creek - Raw		--	--	Note 8
	Morses Creek - Treated		0.27	185	
	Steam		0.07	50	Note 9
	Utility		0.55	380	Note 8
	Rain		0.11	76	
		SUB-TOTAL	1.2	833	
Linden Research	Utility		0.25	175	
	Steam		0.09	65	
	Rain		0.01	5	
		SUB-TOTAL	0.4	245	
		TOTAL	7.7	5,344	Note 6

Note 1: Utility water is purchased from Elizabethtown Water Company.

Note 2: Includes 250,000 GPD from Research.

Note 3: Scrubber purge (0.67 MGD) and evaporation (0.4 MGD) less COB blowdown (0.23 MGD); made up by raw water (.63 MGD) and utility water (.21 MGD).

Note 4: Utility air compressors.

Note 5: 528 GPM to PSE&G and 542 GPM to Bayway water treating plants.

Note 6: Includes 0.56 MGD contaminated rainwater.

Note 7: 107 GPM blowdown; 1,063 GPM returned as steam.

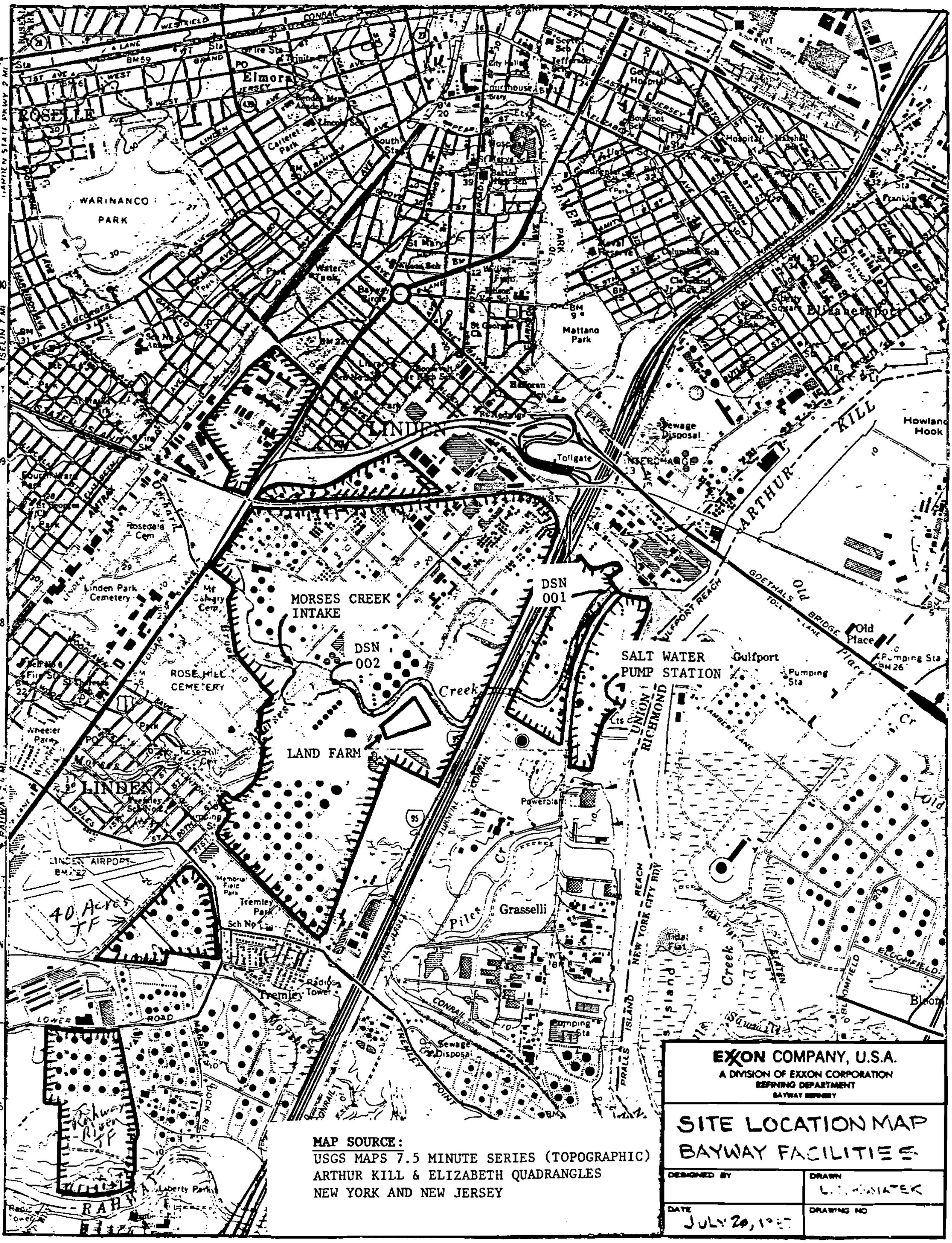
Note 8: Includes portion of 0.67 MGD Wet Gas Scrubber purge; see Note 3.

Note 9: Steam is produced from both utility and treated water from Morses Creek at both Exxon and PSE&G.

Note 10: Feed at 15 GPM minus 5 GPM products = 10 GPM to WWTP.

General Note: All data based on 7/1/88 - 6/30/89 time period.

HVH/vob
August 21, 1989

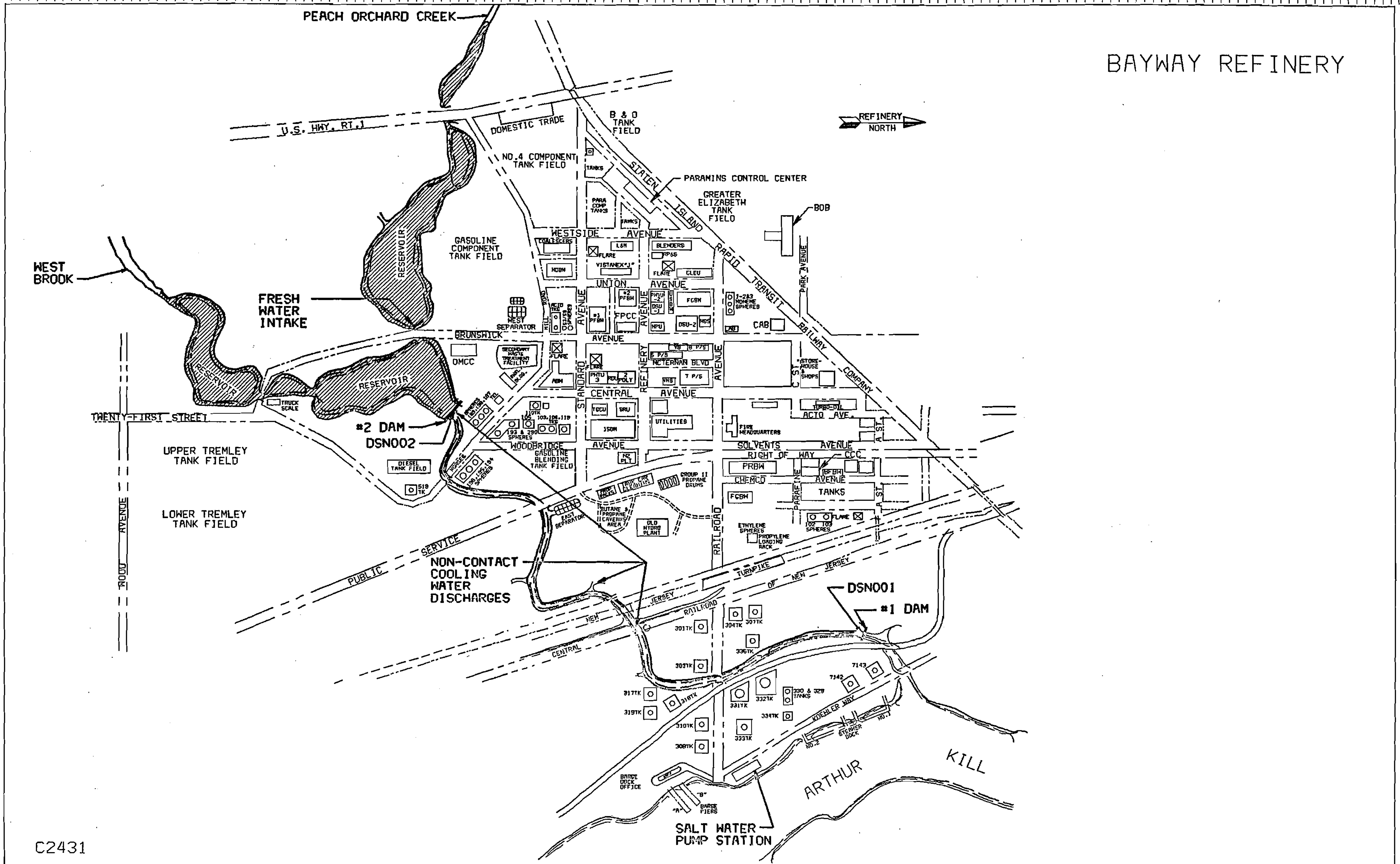


MAP SOURCE:
USGS MAPS 7.5 MINUTE SERIES (TOPOGRAPHIC)
ARTHUR KILL & ELIZABETH QUADRANGLES
NEW YORK AND NEW JERSEY

EXXON COMPANY, U.S.A.
A DIVISION OF EXXON CORPORATION
REFINING DEPARTMENT
BAYWAY REFINERY

SITE LOCATION MAP
BAYWAY FACILITIES

DESIGNED BY	DRAWN
	L. [illegible]ATEK
DATE JULY 20, 19[illegible]	DRAWING NO


BAYWAY REFINERY
REFINERY NORTH
PEACH ORCHARD CREEK
U.S. HWY. RT.1
DOMESTIC TRADE
B & O TANK FIELD
NO.4 COMPONENT TANK FIELD
PARAMINS CONTROL CENTER
GREATER ELIZABETH TANK FIELD
BOB
STATEN ISLAND RAPID TRANSIT RAILWAY COMPANY
PARK AVENUE
WESTSIDE AVENUE
GASOLINE COMPONENT TANK FIELD
RESERVOIR
WEST BROOK
FRESH WATER INTAKE
UNION AVENUE
STANDARD AVENUE
REFINERY AVENUE
WEST SEPARATOR
BRUNSWICK AVENUE
OMCC
SECONDARY WASTE TREATMENT FACILITY
FPCC
FCBH
CAB
MCTERNAN BLVD
CENTRAL AVENUE
UTILITIES
ACTO AVE.
TWENTY-FIRST STREET
TRUCK SCALE
#2 DAM
DSN002
UPPER TREMLEY TANK FIELD
LOWER TREMLEY TANK FIELD
WOOD AVENUE
DIESEL TANK FIELD
WOODBRIDGE AVENUE
GASOLINE BLENDING TANK FIELD
SOLVENTS AVENUE
RIGHT OF WAY
CCC
PRBW
CHEMCO
PARAFINE AVENUE
TANKS
FIRE HEADQUARTERS
GROUP II PROPANE DRUMS
EAST SEPARATOR
BUTANE & PROPANE CAVERNS AREA
OLD HYDRO PLANT
RAILROAD
ETHYLENE SPHERES
PROPYLENE LOADING RACK
PUBLIC SERVICE
NON-CONTACT COOLING WATER DISCHARGES
NEW JERSEY TURNPIKE
CENTRAL RAILROAD OF NEW JERSEY
DSN001
#1 DAM
KOEHLER WAY
STEAMER DOCK
BARGE DOCK OFFICE
BARGE PIERS
SALT WATER PUMP STATION
ARTHUR KILL
C2431

MEMORANDUM ON APPROPRIATE WATER USE CLASSIFICATION

FOR MORSES CREEK - EXXON BAYWAY REFINERY

DATED: AUGUST 22, 1989

Introduction.

Morses Creek is the subject of a hearing pending before the New Jersey Department of Environmental Protection ("DEP") as to what classification should be given to it for water use purposes. The creek is located entirely within Exxon's Bayway Refinery in Linden, New Jersey. The classification of Morses Creek is intimately related to the surface water discharge permit for the Bayway facility which is currently up for renewal. The creek is currently used only for industrial purposes in the discharge of Exxon's cooling water, treated process water and storm water runoff during wet weather. Its physical characteristics and historical background make it unique from other bodies of water. The assignment of uses to Morses Creek is controlled by the federal regulation 40 C.F.R. 131.10. An analysis of what classification is appropriate demonstrates that discontinuance of the present use of Morses Creek would result in detriment to the environment without any corresponding benefit. The cost of implementing such change would be of such magnitude to even question the viability of continued refinery operations.

Description and History of Morses Creek

Morses Creek is a small tidal inlet from the Arthur Kill located entirely within the confines of the Exxon Bayway Refinery in Linden, New Jersey. Since the inception of the Bayway Refinery in 1909, Morses Creek has been used to return water pumped in from the Arthur Kill to cool process equipment. The noncontact cooling water is discharged between two dams which were constructed on the creek in 1922. Upstream, No. 2 Dam impounds fresh water to be used in the process operation. Treated process water from Bayway's Waste Water Treatment Facility is also discharged below No. 2 Dam. The discharge of cooling water and the treated process water constitutes over 99% of the dry weather flow of Morses Creek at this point. No. 1 Dam located downstream, near the mouth of Morses Creek, prevents tidal flow upstream and controls the discharge of the combined cooling and process waters. Both discharges are strictly monitored for toxics and other pollutants.

In 1927, Exxon's predecessor obtained a grant to the bed of Morses Creek from the State of New Jersey. [(1)] This conveyed to Exxon the interests of the State to the tidal waters and the lands which they cover. Schultz v. Wilson, 44 N.J. Super. 591 (App. Div. 1957). In 1938, the dams were formally approved by the State Water Policy Commission. [(2)] In 1938, Morses Creek was declared to be non-navigable by the U. S. Army Corps of Engineers 500 feet upstream from its mouth. [(3)] Portions of

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(1) Exhibit 1, Grant to Morses Creek (1927)
(2) Exhibit 2, letter from State Water Policy Commission (1938)
(3) Exhibit 3, letter from Corps of Engineers

the original creek bed were relocated to accomodate construction on the New Jersey Turnpike in 1967. (4) This relocation, together with sheathing, periodic dredging and the functioning of the two dams have transformed the creek into a discharge canal, which is an integral part of Exxon's water treatment facility. Two booms have been constructed between the dams to contain any spills within the refinery or any leaks within the process equipment. There is also located within this segment a pumping station to provide water for Exxon's in-plant fire fighting brigade.

Ecological Data on Morses Creek.

The fish studies conducted on Morses Creek demonstrate that it is an unfavorable habitat for aquatic biota. Untreated cooling water pumped in from the Arthur Kill makes up over 90% of the dry weather flow in Morses Creek. The Arthur Kill has been included by the DEP as a 304(1) "short list" water segment in acknowledgment of its distressed condition. This poor water quality, together with an unnatural habitat formed by sheathed bulkhead banks and scarce aquatic vegetation between two dams, results in minimal aquatic activity. Based on prior studies, the aquatic community above No. 1 Dam is almost exclusively the mummichog, a small and insignificant species. Below No. 1 Dam, the mummichog is again the dominant fish, along with the grass shrimp and the sand shrimp. The more varied fish life found in the Arthur Kill will not be adversely affected by the plume from Morses Creek. (5) A study completed in August, 1989 confirms that these conditions remain unchanged. (6)

Morses Creek is surrounded by industrialized areas which eliminates any potential for secondary contact recreation. (7) The salinity of the water negates its use as a public or agriculture water supply.

The studies which have been performed and a visual observation of the creek clearly demonstrate that no use of the creek, other than for industrial purposes, is either existing or attainable.

Regulatory History.

The issue of the use of Morses Creek for Exxon's

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(4) Exhibit 4, Agreement with New Jersey Turnpike Authority
(5) Exhibit 5, Transcript of testimony, Public Hearing on Proposed Surface Water Quality Standards, June 8, 1985, pg. 23 to 34.
(6) Exhibit 6, Study Environmental Consulting Services, August, 1989
(7) Exhibit 5, pg. 27, 32.

industrial purposes began with the inception of the federal NPDES program in the early 1970's. EPA in acting upon Exxon's application for a discharge permit recognized the impracticality of forcing Exxon to construct another discharge conveyance. A draft permit was issued recognizing the Arthur Kill as the receiving body of water. (8) In December, 1974, New Jersey amended its Surface Water Quality Standards. The Tidal Portion of Morses Creek was classified as TW-3 waters. (9) No other portion of Morses Creek was classified. Nontidal tributaries to Morses Creek were classified as FW-3. The thermal criteria placed a limitation of 85 degrees F. during June through August with a maximum increase of 1.5 degrees F. in ambient. The temperature was to be measured outside the designated mixing area. (10) Under NPDES regulations, New Jersey certified to EPA that Exxon's discharge had to meet its water quality standards in Morses Creek. Exxon's NPDES Permit was revised to reflect this. Acting upon Exxon's petition for relief, the DEP conducted an extensive public hearing which resulted in the reclassification of the Tidal Portion of Morses Creek as TW4(a). (11)

The amendment was approved by Gerald M. Hansler, Regional Administration of the EPA on February 6, 1976. (12) After ensuing litigation between EPA and PIRG was privately settled by those parties, the EPA, on April 24, 1980, rescinded this approval on procedural grounds. (13) Exxon's suit against the EPA to enjoin the revocation was stayed and ultimately administratively dismissed because the State of New Jersey was affording Exxon an administrative hearing on the proposed reclassification of Morses Creek. (14) After public hearing on this and other amendments to the Water Quality Standards, Exxon was granted a separate hearing to determine this issue. The present status was to be maintained until the issue was resolved. (15) The revision proposed in 1980 would have classified the Tidal Portion of Morses Creek as TW-3 and Morses Creek and its tributaries as FW-2 Nontrout. (16) The only temperature criteria was to be that the water temperature shall not be greater than 90 degrees F. measured at No. One Dam. (17) Even this proposal recognized that forcing Exxon to discontinue use of the creek would create a patently absurd situation. (18)

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(8) Exhibit 7, NPDES Draft Permit (1974)
(9) Exhibit 8, 1974 Amendments to SWQS, pg. 59, 60.
(10) Exhibit 8, pg. 24.
(11) Exhibit 9, Opinion of Commissioner Bardin
(12) Exhibit 10, letter of G. Hansler, February 6, 1976
(13) Exhibit 11, letter of C. Warren, April 24, 1980
(14) Exhibits 12 and 13, motion and Brief of EPA - Exxon v. Costle, March, 1980, letter of C. Warren, April 9, 1980
(15) Exhibit 14, letter of Douglas Clark, July 23, 1980
(16) Exhibit 15, 1980 Amendments to SWQS pg. II 57, 77.
(17) Exhibit 15, pg. 27.
(18) Exhibit 16, Letter of Arnold Shiffman, February 11, 1980

The hearing granted to Exxon in 1980 by the DEP has never been held. In 1984, the DEP proposed revisions to its Water Quality Standards. Morses Creek was designated as FW-2 Non-Trout, SE-3. The SE-3 general classification replaced TW-3. The 90 degrees F. thermal limitation for Morses Creek was deleted so that the thermal limitation would be 85 degrees F. during June through August, with a maximum increase of 1.5 degrees F. [19] In January 1985, Exxon appeared at the public hearing on the proposals and presented testimony which included the fact that the hearing granted to it by the DEP had never been held. One of the DEP panel members stated that in order to have the issue heard, Exxon should petition the DEP for a reclassification of Morses Creek in accordance with the DEP and EPA regulations on this procedure. [20] Exxon filed a conditional application for reclassification which included the endorsement of the Linden City Government. Again, Exxon was granted a separate hearing on this issue. [21] In 1988, the exact same scenario was repeated. [22] To date, no hearing on the classification of Morses Creek has ever been held.

Compliance with Proposed Regulation.

The 85 degrees F. thermal limitation, with no opportunity for dissipation in a mixing zone, operates effectively as an effluent limitation. Due to the volume of cooling water involved and the high temperature of the intake water, compliance with the limitation can be achieved, if at all, only by drastic revisions in Exxon's process operations. The revisions are described in the alternatives set forth below.

Compliance with limitations other than thermal are also rendered impossible due to the man made and natural conditions existing in the creek. As stated previously, the creek is used as an integral part of Exxon's treatment system for oil containment and recovery. This results at times in the presence of an oil sheen on the creek just upstream of the booms where fugitive oil is consolidated and removed prior to discharge over #1 Dam. It has also been pointed out that dry weather flow in Morses Creek consists of 90% untreated Arthur Kill water, which is a 304(1) short list segment. Thus, it is impossible for Morses Creek to have better quality water than the Arthur Kill which is its predominant source. Even absent the thermal

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(19) Exhibit 17, 1985 Amendments to SWQS
(20) Exhibit 6, pg. 50
(21) Exhibit 18, Response to public comments, pg. 62
(22) Exhibit 19, 1988 proposed Amendments to SWQS
Exhibit 20, Exxon submittal 1988

problem, Exxon's use of water from the Arthur Kill makes attainment of surface water quality standards in Morses Creek not feasible.

Finally, the Department has requested that Exxon conduct dilution studies in Morses Creek. Aside from Exxon's industrial cooling water and treated wastewater flow, additional dry weather flow in the creek above #1 Dam is zero and, thus, any dilution study is meaningless.

Current EPA Regulations on Designation of Water Uses.

The EPA regulations have been modified since Exxon first submitted its conditional request for reclassification. Under Section 131.10(g), a state may remove a designated use, which is not an existing use, where certain conditions prevent the attainment of that use. [23] These include the existence of dams, diversions, lack of flow and natural and human caused conditions. It is without question that the designated uses set forth in Section 131.10(a), other than industrial, are not existing in Morses Creek. It is also easily demonstrated that attainment of any use other than industrial is not feasible or cannot be done without causing more environmental damage to correct than to leave in place. Designation of the use of Morses Creek as industrial is consistent with regulations which have been adopted in many other states. [24] Treating it as a Discharge Canal is consistent with the EPA "Blue Book." [25]

Alternative Systems.

Various systems have been described for possible compliance with thermal limitations in Morses Creek in previous submittals by Exxon. These systems possess no capability for removal of pollutants, other than heat. Even if they were to be put in place, attainment of water quality standards on Morses Creek could not be achieved. The cooling water is pumped in from the Arthur Kill, which has been designated under Section 304(l) of the Federal Clean Water Act as a stream which does not meet water quality standards. Therefore, attainment of these standards cannot be met in a flow consisting principally of discharge of these cooling waters.

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(23) Exhibit 21, EPA Regulation 40 C.F.R. 131.10.
(24) Exhibit 22, Survey of States with Industrial Use Classifications.
(25) Exhibit 23, Water Quality Criteria, Report of the Committee on National Academy of Engineering, Washington, D. C., 1972, EPA R. 3-73.003 March, 1973.

1. **Construction of alternate discharge canal parallel to the creek to transmit all of the Refinery's discharges to the Arthur Kill.**

The cost estimate of this construction was fifty million dollars in 1985. This diversion would render no benefit to the ecology as the impact on the Arthur Kill as the receiving body would be the same. (26) In fact, if a closed piping system is used, the thermal impact will be greater as the cooling effect of the passage of the discharge water along Morses Creek would be lost. A detriment would occur as the discontinuance of the discharges would leave the creek bed periodically dry with exposure of the silted bottom. The use of the containment booms on the creek would also be lost and the pumping station for emergency water rendered inoperable.

2. **Conversion to recycle cooling water system.**

This would require the installation of additional cooling towers which would entail the addition of corrosion inhibitive chemicals and create additional salt drift. The same ecological detriment as present in Alternative One above would occur as the discharge of cooling and process waters would be discontinued. The estimated cost would be approximately $70,000,000. (27)

3. **Conversion to an air cooling system.**

Conversion to air cooling would involve essentially the same environmental considerations as installing recycled cooling water. These would be the dry creek bed, the stagnant water condition and loss of containment system. It would require extensive retrofitting, would be energy intensive and economically prohibitive, as the cost estimate would be approximately the same as recycled water cooling. (28)

4. **Spray cooling system.**

This would require the intensive use of pressurized spray cooling or the use of multiple floating coolers in the water segment. It would entail dredging of the creek to a depth of ten feet which would create dredged soil

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(26) Exhibit 5, pg. 21, 22, Exhibit 9, pg. 7
(27) Exhibit 5, pg. 39, 40
(28) Exhibit 5, pg. 41, 42

disposal problems. It would require as much as 900,000 kilowatt hours per day of energy during the four hot weather months when power usage becomes critical. The oil recovery system in the creek would no longer be effective. The estimated cost would be a $12,000,000 capital outlay with high operating costs. [29]

5. Dilution of discharge waters by pumping additional waters from the Arthur Kill.

The installation of additional pumps at the Arthur Kill to dilute the discharge waters on their entrance to Morses Creek would cost $20,000,000. This method would not work when the temperature of the intake waters exceeds or approaches the thermal maximum. It would create an additional power demand and would involve all the environmental problems associated with the recirculation of a calculated flow of 260,000,000 gallons per day. [30]

These alternative systems have been reviewed and updated. Compliance with limitations on pollutants, other than heat, dictate that systems Nos. 4 and 5 which entail some continued use of the creek are no longer even theoretically viable.

Current Analysis of Alternative Systems.

Recent developments in Federal/State Permitting Strategies and Water Quality Standards development, such as the 1987 Amendments to the Water Quality Act, proposed Federal stormwater permitting requirements and EPA guidance on use of both chronic and acute whole effluent toxicity testing have caused Exxon to re-evaluate the viability of the historical options in terms of achieving total regulatory compliance consistent with the SE-3 designation for Morses Creek.

As has been previously stated, the Arthur Kill is a 304(l) short listed stream, and as such does not meet water quality standards due to toxics. Therefore, it is improbable that a stream consisting of 90% untreated Arthur Kill water (the cooling water portion of the discharge to Morses Creek) would meet toxic standards. Additional concerns are Dissolved Oxygen and Total Residual Oxidants. Since the Wastewater Treatment Plant accounts for 10% of stream flow, it would have to show

(29) Exhibit 5, pg. 40
(30) Exhibit 5, pg. 41, 42

no acute or chronic bioassay sensitivity whatsoever to be in compliance. The presence of localized oil sheens at the oil recovery containment booms also preclude compliance. Lastly, as previously described, the thermal limitation of 85 degrees F, with no mixing zone opportunity, amounts to an insurmountable obstacle to compliance with SE-3 Water Quality Standards.

Thus, the only option available would be similiar to those earlier alternatives, which involve the complete removal of all Exxon discharges to Morses Creek. Three alternative configurations are being examined. All three are being designed consistent with current engineering practice of eliminating ditches and minimizing in-ground facilities. The facilities are being evaluated with total treatment of site point source storm run-off up to a 15 year return frequency storm, consistent with proposed Federal Regulations. These alternatives are described below:

Alternative 1 -- Retention of Once-Through Cooling System

In this configuration, massive above ground concrete oil/water separators would be constructed with a capacity of 200 MGD. An off-line 100 million gallon lined stormwater retention surface impoundment would also be required. Additionally, a complex thermal diffuser system would need to be installed in the Arthur Kill. The natural convective cooling of Morses Creek prior to discharge to the Kill would be lost under this scenario.

Alternative 2 -- Use of Salt Water Cooling Towers

This option would trade off the complexity of the required thermal diffuser and the size of the required oil/water separators with construction of large scale salt water cooling towers.

Alternative 3 -- Maximum Use of Air-Fin Coolers with Remaining Heat Load to Fresh Water Cooling Towers

This option would minimize use of water for cooling by using Air Fin coolers located at the process units wherever practical. The remaining heat removal would be accomplished with fresh water cooling towers to eliminate the problems associated with salt water cooling towers. Blowdown from the fresh water cooling towers would be processed in the existing wastewater treatment plant.

Environmental Impact

- **Effect on Morses Creek**

Absent removal of #1 Dam, Morses Creek would, for the most part of the year, be a dry creek bed. During significant rains, #2 Dam would overflow and during exceptionally high tides #1 Dam would overflow. In both cases, this would create a stagnant water impoundment which would evaporate or discharge to the shallow ground water aquifer.

If #1 Dam were removed, Morses Creek would become a tidal wash with an exposed creek bed during low tides, and minimal ability to support any biota. Water quality would be lower or equal to that of the Arthur Kill since the Kill would be the predominant source of water, yet with less mixing and renewal. As stated in the latest study, Morses Creek constitutes less than 1% of the estuarine area of the Kill, and a totally insignificant portion of the Newark Bay/Raritan Bay estuary.

- **Effect on the Arthur Kill**

Alternative #1 would increase the heat load to the Arthur Kill, since the evaporative cooling now obtained from Morses Creek would be lost. There would be no less pollutant load discharged to the Kill, since all cooling water originates from the Kill and the Wastewater Treatment Plant effluent load would still go to the Kill. If a cooling tower alternative were used, the pollutant load would increase since chemical additives would be necessary for proper cooling tower operation.

The substitution of an oil-water separator for the current oil recovery and skimming facility now in Morses Creek would render less effective controls for keeping oil out of the Arthur Kill. If #1 Dam were removed, oil spills which reached the creek would not be dealt with as effectively as now. In addition, highly oil contaminated storm run-off from the New Jersey Turnpike, which is now contained by Exxon skimming facilities, would pass directly to the Arthur Kill, as would oily storm run-off from the City of Linden drainage basin during #2 Dam overflow events.

- **Other Environmental Impacts**

Alternative 2 would further introduce salt drift and fog, potentially causing corrosion and visibility problems both in the refinery, on the New Jersey Turnpike and the aviational approach to Newark Airport.

Alternative 3 would require substantial additional electric power requirements, with the pollution attendant to the generation of that additional electric power. It would also use very high quantities of potable water for an industrial use for which that quality of water is not necessary, since Elizabethtown Water would be the only available source of additional fresh water.

Both alternatives 2 and 3 would directly release additional heat to the atmosphere in an already highly industrialized area, instead of using the Arthur Kill to slowly release heat in a minimally environmentally impacting manner.

Cost Impacts

Scoping costs to the three current alternatives are being developed. The simpler previously presented alternatives had costs estimated at $40,000,000 to $70,000,000. Potential costs with escalation from the earlier estimates are in the range of $75,000,000 to $100,000,000.

Attainment Analysis

As stated previously, the water quality of Morses Creek would not improve as a result of these high expenditures to install facilities with an overall negative environmental impact. Morses Creek would still remain completely on Exxon property with no public access. It would still have embankments consisting primarily of bulkheads and riprap. All of the environmental detriments described in the earlier alternatives from the discontinuance of the Exxon discharge in the creek would be present. No beneficial, social or ecological impacts are foreseeable from the elimination of Exxon discharges to Morses Creek. There are no other existing uses in the creek, nor would any other be attained without major disruption in Bayway's operation and the creation of significant environmental harm.

CONCLUSION

The classification of Morses Creek for industrial use would be an appropriate exercise of the discretion placed in the states by 40 C.F.R. Section 131.10. The grant of the creek to Exxon by the State, the existence of the dams and other physical features make Morses Creek so unique that no precedent would be established for other situations.

List of Exhibits

1. Grant to Morses Creek (1927)
2. Letter from State Water Policy Commission (1938)
3. Letter from Corp. of Engineers (1938)
4. Agreement with New Jersey Turnpike Authority
5. Transcript of hearing on Proposed Surface Water Quality Standards January 8, 1985.
6. 1989 Fish Study
7. Draft Permit 1974
8. 1974 Surface Water Quality Amendments
9. Opinion of Commissioner Bardin, July 1975
10. Letter of Gerald Hensler of the EPA, February 6, 1976.
11. Letter of C. Warren of the EPA, March, 1980
12. Motion and brief on behalf of the EPA, March, 1980
13. Letter of C. Warren of the EPA, April 9, 1981.
14. Letter of Douglas M. Clark, July 23, 1980
15. 1980 Amendments Surface Water Quality Standards.
16. Letter of Arnold Schiffman, February 11, 1980
17. Proposed revisions to Surface Water Quality Standards, January, 1985
18. Response to public comments, April 29, 1985
19. Proposed Surface Water Quality Standards, July, 1988.
20. Exxon submittal.
21. EPA Regulation 40 C.F.R. 131.10
22. Survey of States with Industrial Use Classification
23. Excerpts from EPA Blue Book, pg. 167, 171. Water Quality Criteria, EPA R. 3-73.003, March, 1973

A Biological Characterization of Morses Creek

for

Exxon Co. USA
Bayway Refinery
Contract No. FGWA 02727-HV 30591

Environmental Consulting Services, Inc.
100 South Cass St.
Middletown, DE 19709

Scott J. Beck
Principal Investigator

August 10, 1989

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FIGURE

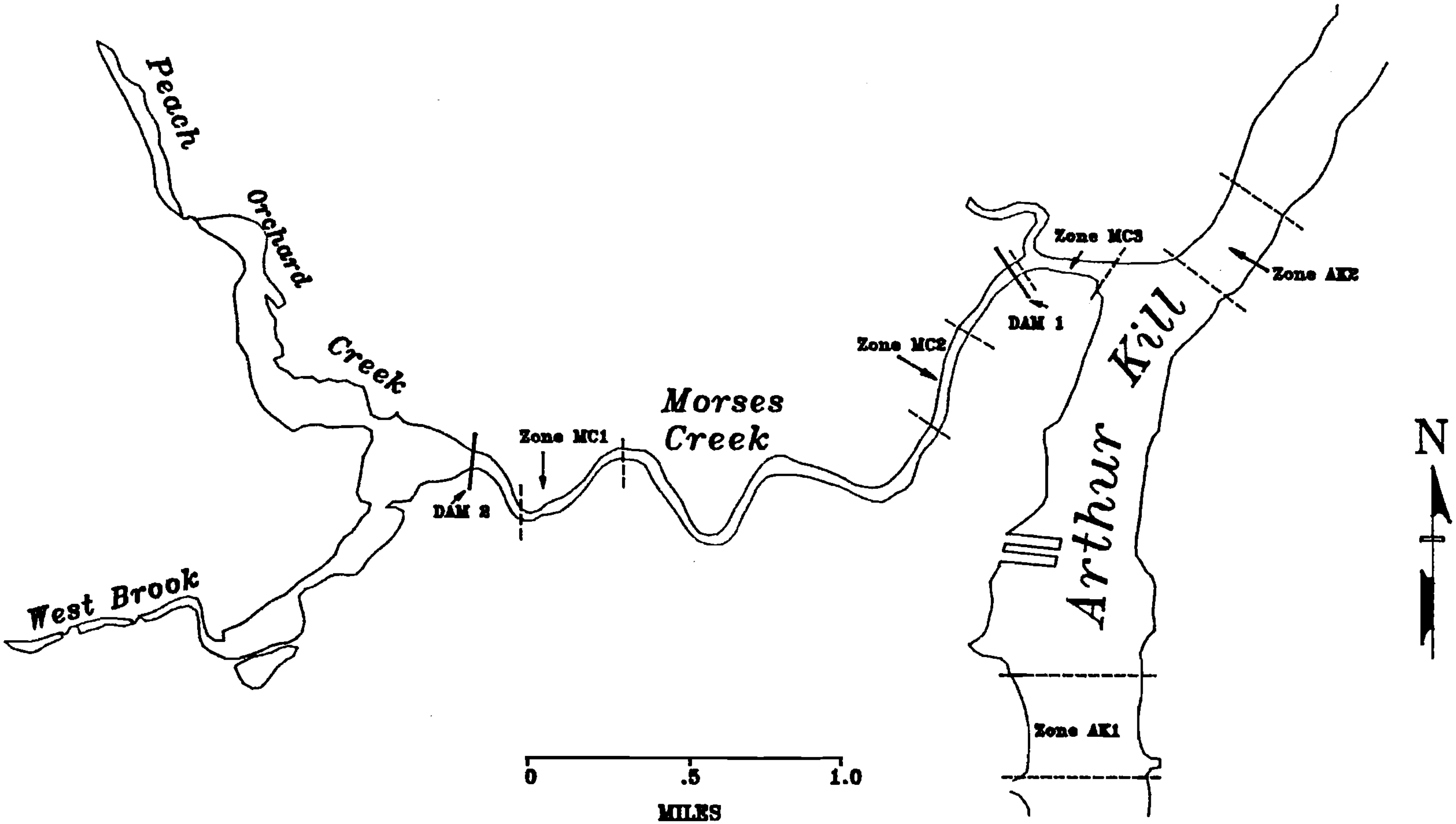

Figure 1

DATE 7/28/89

SCALE

EXXON CO. USA

Map of:
Morses Creek and proximal reach of Arthur Kill, depicting the five sampling zones.

ENVIRONMENTAL CONSULTING SERVICES Inc.
100 SOUTH CASS ST
MIDDLETOWN DE 19709

INTRODUCTION

Environmental Consulting Services, Inc. (ECSI), under contract with Exxon Co., USA, conducted a biological survey on July 11, 1989 to characterize the biota of lower Morses Creek. The study emphasized two indicator/profile biotic communities, fishes and macroinvertebrates. To provide a basis for comparison, sampling was also conducted in the Arthur Kill in an area proximal to the confluence of Morses Creek.

This report presents the findings of this study and provides a qualitative appraisal of the utilization and relative value of Morses Creek.

STUDY AREA DESCRIPTION

Briefly, Morses Creek is a small (< 5 km) tributary stream of the Arthur Kill (Fig. 1). Two dams are located along its length; these are situated about 300 m and 1.6 km from the creek mouth. The area between the dams serves as the receptacle for Exxon refinery's cooling water and treated process waste water discharges, which make up 99 percent of dry creek flow. Virtually all of the shoreline of Morses Creek has been modified by bulkheads or riprap. The bottom sediment consists mostly of soft, black mud. Although some littoral areas are present, most of the creek has steep-sided banks; no aquatic macrophytes are present. Above No. 1 Dam, the water depth is less than 2 m.

The Arthur Kill is a narrow tidal strait connecting the Kill Van Kull and Raritan Bay. It is approximately 20 km in length, averages 0.5 km in width, and has a dredged shipping channel 11 m in depth. The land contiguous to the Arthur Kill is heavily industrialized. Much of the natural littoral and wetland habitats of the Arthur Kill have been eliminated by dredging, bulkheading, road and highway construction, and landfilling operations.

MATERIALS AND METHODS

Sampling was conducted at five locations (Fig. 1). Within Morses Creek, sampling zones were located shortly below No. 2 Dam (MC1), above No. 1 Dam (MC2) and between No. 1 Dam and the creek mouth (MC3). In the Arthur Kill, two sampling stations were established, one opposite the mouth of Morses Creek (AK2) and the other approximately one mile downstream (AK1). Within the two Arthur Kill zones, sampling was conducted inshore (designated suffix 1) and offshore (suffix 2).

Three gear types, i.e., bottom trawl, plankton net and bottom grab sampler, were employed to sample finfishes and macroinvertebrates at each station. The bottom trawl was a 2.7-m otter trawl with a net body and codend liner of 3.8 and 1.3 cm stretch mesh, respectively. The plankton net was a standard bridled 0.5 m diameter, 0.5-mm mesh, conical net. Sample volume was determined with a General Oceanics digital flowmeter. The grab sampler was a Ponar model with a mouth opening of 14 x 14 cm. Samples were washed in a U.S. Standard Sieve No. 35 with 0.5 mm openings.

RESULTS

Sampling revealed a rather sparse aquatic fauna in that reach of Morses Creek between the two dams. Biotic community compositions were essentially monospecific. Among fishes, only mummichog (F. heteroclitus) was represented by more than one specimen. The occurrence of the single golden shiner (N. crysoleucas), collected at MC1 (Table 1), was probably the result of overflow from impoundments above No. 2 Dam. Bay anchovy (A. mitchilli) larvae, collected at MC2 (Table 2), most likely originated from the Arthur Kill, having been entrained through Exxon refinery cooling system and discharged into Morses Creek. The macroinvertebrate community was somewhat more diverse. Although no planktonic forms were observed, benthic species collected were polychaete worms, the snail, L. vinta and the barnacle (Balanus). That part of Morses Creek below No. 1 Dam (zone MC3) was only slightly more diverse with the addition of the epibenthic blue crab, C. sapidus, and sand shrimp, C. septemspinosa.

For all communities investigated, those existing in Morses Creek were substantially less diverse than the analagous community in the proximal reach of the Arthur Kill.

DISCUSSION

The biota of lower Morses Creek reflects a stressed aquatic environment, being restricted to a few species, technically classified as "tolerant", which are capable of utilizing poor or degraded environments. The Creek appears to be in an irretrievable state which is unfavorable for supporting a more diverse biotic community. As such, the biological value of the waterway is relatively low and could not be considered critical or important to the maintenance of regionally indigenous aquatic populations.

The loss of the Creek as available habitat to local populations is probably minimal. Areal measurements (by use of polar planimeter) show that the reach of Morses Creek below No. 2 Dam comprises an estimated 15 hectares of aqueous habitat. This represents less than one percent of the more than 2,000 hectares of estuarine habitat within the Arthur Kill and obviously a much smaller percentage of that available within the contiguous Hudson and Raritan systems.

Table 1
Numbers of fish and macroinvertebrates taken by bottom trawl in Morses Creek and Arthur Kill on July 11, 1989.

	MC1	MC2	MC3	AK1 Onshore	AK1 Offshore	AK2 Onshore	AK2 Offshore
Temperature (°C)	33.0	33.0	33.0	25.0		25.0	
Dissolved Oxygen (mg/1)	6.0	6.6	6.1	6.4		6.0	
Salinity (ppt)	23.0	17.5	17.0	18.0		17.5	
Conductivity (mhos)	27,000	31,500	29,500	28,000		28,000	
Secchi (inches)	35	36	30	-		-	
FISH							
N. crysoleucas	1	-	-	-	-	-	-
F. heteroclitus	4	3	-	-	-	-	-
M. tomcod	-	-	-	-	15	-	-
M. saxatilis	-	-	-	1	-	-	-
P. saltatrix	-	-	-	1	-	-	-
MACROINVERTEBRATES							
C. septemspinosa	-	-	3	-	100+	-	-
C. sapidus	-	-	1	7	5	3	-

Table 2
Density ($n/100m^3$) of fish eggs, larvae and macroinvertebrates taken by plankton net in Morses Creek and Arthur Kill on July 11, 1989.

Station	MC1	MC2	MC3	AK11	AK21	AK22
FISH EGGS						
Anchoa mitchilli	-	-	9.9	-	-	44.8
Tautogolabrus adspersus	-	-	-	5.5	-	-
FISH LARVAE						
Anchoa mitchilli	-	44.1	69.3	44.0	130.0	806.4
Sphaeroides maculatus	-	-	-	5.5	-	-
Cynsocion regalis	-	-	9.9	-	-	-
Unidentifiable	-	44.1	-	-	-	-
MACROINVERTEBRATES						
Mollusca						
Gastropoda						
Lacuna vinta	3.2	205.9	-	-	-	-
Annelida						
Polychaeta						
Opheliidae	-	176.4	-	-	-	-
Polydora spp.	-	14.7	-	-	-	-
Streblospio benedicti	-	-	9.9	-	-	-
Polychaeta immature	-	-	-	-	10.0	-
Arthropoda						
Cirripedia						
Balanus spp.	-	396.9	-	-	-	-
Isopoda						
Edotea triloba	-	-	-	-	10.0	-
Decapoda						
Caridea larvae	-	-	138.6	104.5	-	12.8
Mysidacea						
Neomysis americana	-	-	-	-	6.4	-

Table 3
Density (n/m^2) of benthic macroinvertebrates taken by Ponar Grab
in Morses Creek and Arthur Kill on July 11, 1989.

Station	MC1		MC2		MC3		AK11		AK12		AK21		AK22	
Replicate No.	1	2	1	2	1	2	1	2	1	2	1	2	1	2
PHYLUM MOLLUSCA														
Class Bivalvia														
Mya arenaria	-	-	-	-	-	-	-	-	87	173	-	-	1,255	693
PHYLUM ANNELIDA														
Class Polychaeta														
Family Opheliidae	-	-	87	-	-	43	-	-	-	-	-	-	87	173
Family Spionidae														
Polydora spp.	-	-	-	-	-	-	-	-	-	779	-	-	87	43
Streblospio benedicti	-	-	-	-	-	-	-	-	476	8,255	-	-	2,381	303
Scolecolepides viridis	-	-	-	-	-	-	-	-	-	260	-	-	-	173
Family Phyllodocidae														
Eteone spp.	-	-	-	-	-	-	-	-	130	1,169	-	-	173	173
Family Nereidae														
Nereis succinea	-	-	-	-	-	-	-	-	-	43	-	-	-	-
Nereis spp.	-	-	-	-	-	-	-	-	-	-	-	-	130	-
Family Sabellariidae														
Sabellaris vulgaris	-	-	-	-	-	-	-	-	-	87	-	-	-	-
PHYLUM ARTHROPODA														
Class Crustacea														
Cirripedia														
Balanus spp.	-	87	-	-	-	-	-	-	130	649	-	-	-	87
Malacostraca														
Isopoda														
Edotea triloba	-	-	-	-	-	-	-	-	43	130	-	-	87	173
Mysidacea														
Neomysis americana	-	-	-	-	-	-	-	-	216	-	-	-	-	-
Decapoda														
Caridea larvae	-	-	-	-	-	-	823	-	130	-	-	-	-	-
Family Cranginidae														
Crangon septemspinosa	-	-	-	-	-	-	-	173	-	-	-	-	43	-
PHYLUM UROCHORDATA														
Ascidiacea	-	-	-	-	-	-	-	-	130	-	-	-	-	-

State of New Jersey
DEPARTMENT OF ENVIRONMENTAL PROTECTION
DIVISION OF WATER RESOURCES
TRENTON, NEW JERSEY 08625
Arnold Schiffman
Director

FEB 11 1980

Mr. R.K. Altreuter
Environmental Coordinator
Exxon Company, U.S.A.
P.O. Box 222
Linden, New Jersey 02038

Dear Mr. Altreuter:

This is in reply to your letter of February 6, 1980 regarding Morses Creek. Pursuant to the federal regulations governing classification of state waters, we cannot technically support an aberrant classification such as TW-4a. However, I strongly support the position of not applying conventional stream requirements to the canal portion of Morses Creek.

Please understand that, in my opinion, this problem has become somewhat symbolic in the battle over downgrading procedures.

The environmental impact of your discharge should be measured in the main tidal body of water below dam #1, not the canal. If you spent millions of dollars to cover the canal and made it a pipe, there would be no problem. This is a patently absurd situation.

If we persist with a TW-4a classification, we will be challenged on technicalities, and we will probably lose. I believe that the downgrading issue can be avoided by applying a sensible water quality standard to the discharge from dam #1. We believe that what we are proposing in the regulations satisfies each of our needs.

Please call me if you have any questions.

Very truly yours,

Arnold Schiffman
Director

cc: D. Clark
D. Mattek
R.V. Guerrieri

State of New Jersey

DEPARTMENT OF ENVIRONMENTAL PROTECTION
DIVISION OF WATER RESOURCES
P. O. BOX CN-029
TRENTON, NEW JERSEY 08625

ARNOLD SCHIFFMAN
DIRECTOR

Mr. David J. Mahoney, Jr.
Senior Counsel
Exxon Company, U.S.A.
P.O. Box 222
Linden, New Jersey 07036

JUL 23 1980

Re: Water Quality Standard
for Tidal Portion of Morses Creek

Dear Mr. Mahoney:

This is in response to your letter of June 27, 1980 in which you requested that the Department conduct a separate hearing concerning the water quality standard for the tidal portion of Morses Creek, Linden.

Your request for a hearing is hereby granted. We have received your presentation on the thermal effect of Exxon's discharge on the Arthur Kill. May we suggest that a copy of that report be forwarded to Mr. Conrad Simon at EPA Region II, if you have not already done so.

At this time we are unable to provide any further information concerning the hearing, however, we will be communicating with you again on this subject in the very near future. It is our understanding, also, that the present status will be maintained as to the regulation of Exxon's discharge until the water quality standard issue is resolved.

Sincerely yours,

Douglas M. Clark

Douglas M. Clark
Assistant Director
Monitoring and Planning Element

BMG:DMC:aj

State of New Jersey

JOHN W. GASTON JR., P.E.
DIRECTOR

DEPARTMENT OF ENVIRONMENTAL PROTECTION
DIVISION OF WATER RESOURCES
CN 029
TRENTON, NEW JERSEY 08625

DIRK C. HOFMAN, P.E.
DEPUTY DIRECTOR

NOV 18 1983

Rec'd 11/29/83
Revised permit received 12/8/83

Exxon Company, U.S.A.
P.O. Box 222
Linden, NJ 07036

Re: W.S. Permit No. 4026PS

Gentlemen:

There is enclosed a corrected permit dated NOV 18 1983 issued to you pursuant to the Water Supply Management Act, PL 1981, c262 and in accordance with your application filed on February 2, 1982.

The permit is to divert water from Morses Creek in the City of Linden, Union County, New Jersey.

Your attention is called to Specific Condition No. 11, whereby your acceptance of the terms and conditions to the subject permit, in the form of a letter, must be submitted within 60 days of the date of this letter.

Very truly yours,

William Whipple, Administrator
Water Supply and Watershed
Management Administration

Enclosure

CC: Water Allocation Office

CERTIFIED MAIL
909-748

NOV 18 1983

Exxon Company, U.S.A.
P.O. Box 222
Linden, NJ 07036

Re: W.S. Permit No. 4026PS

Gentlemen:

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Very truly yours,

ORIGINAL SIGNED BY

William Whipple, Administrator
Water Supply and Watershed
Management Administration

Enclosure

CC: Water Allocation Office

CERTIFIED MAIL
909-748

Let's protect our earth

STATE OF NEW JERSEY
DEPARTMENT OF ENVIRONMENTAL PROTECTION
CN 402
Trenton, N.J. 08625

PERMIT

he New Jersey Department of Environmental Protection grants this permit in accordance with your application, attachments ccompanying same application, and applicable laws and regulations. This permit is also subject to the further conditions nd stipulations enumerated in the supporting documents which are agreed to by the permittee upon acceptance of the permit.

Permit No.	Issuance Date	Effective Date	Expiration Date
4026PS	September 14, 1983	September 14, 1983	July 31, 1998

Name and Address of Applicant	Location of Activity/Facility	Name and Address of Owner
Exxon Company, U.S.A. P.O. Box 222 Linden, NJ 07036	City of Linden Union County	Exxon Company, U.S.A. P.O. Box 222 Linden, NJ 07036

Issuing Division	Type of Permit	Statute(s)	Application No.
Water Resources	Water Diversion Allocation (Corrected)	NJSA 58:1A-1	4026PS

This permit grants permission to:

Divert water from Morses Creek in the City of Linden, Union County, New Jersey.

In compliance with the provisions of N.J.S.A. 58:1A-1 et seq., Exxon Company, U.S.A., filed an application with the Division of Water Resources on February 2, 1982, for renewal of a permit to divert a maximum of 446 million gallons of water during any month, at a maximum rate of 10,000 gallons per minute from Morses Creek, tributary to Arthur Kill, in the City of Linden, Union County. The point of diversion is located at Dam No. 3, just upstream of Brunswick Avenue, in the City of Linden, Union County. Diversion will supply the refinery's treatment plants and for steam production.

This permit is subject to the general conditions and to the following specific conditions:

1. The amount of water that may be diverted under this renewal permit shall be as follows:

No. of Pumps	Capacity (gpm)
2	3500 each
2	1500 each

2. The total allocation from the above sources shall not exceed 446 million gallons per month at a maximum rate of 10,000 gpm.

3. The total diversion for each month shall be reported quarterly to the Water Allocation Office.

4. The pumping equipment capacity shall not be increased without prior approval by the Division.

5. Diversion may be metered or calculated using the total hours of operation and the pumping rate. The computed amount of water diverted each month, together with the total amount of water returned each month shall be reported quarterly as in 3 above.

Approved by the Department of Environmental Protection

By authority of
John W. Gaston, Jr., Director
Division of Water Resources

William Whipple, Administrator
Water Supply and Watershed Management Administratio

NOV 18 1983
DATE

* *The word permit means "approval, certification, registration, etc."*

(GENERAL CONDITIONS ARE ON THE REVERSE SIDE.)

Specific Conditions Cont'd.

6. Permittee shall have the right to apply at any time for modification of this permit by submission of the appropriate application forms. Permittee may informally discuss the terms and conditions of this permit at any time with the Water Allocation Office. An application for renewal shall be filed 3 months prior to the expiration date.

7. If the permittee fails to comply with any of the terms and conditions herein, or in the public interest and after due process, this approval may be reviewed for possible modification or revocation thereof.

8. The Division, at its option, may cause the permit to be reviewed at intervals of not less than 5 years to examine the need for the allocation and to determine compliance with the terms and conditions of the permit and whether a modification to the permit is necessary.

9. The permittee is subject to such initial, renewal and annual fees as may be prescribed by the regulations.

10. This permit shall expire on July 31, 1998.

11. This permit shall not become operative unless and until the applicant has filed an acceptance of the terms and conditions hereby imposed, within 60 days of the date of transmittal hereof.

This permit is subject to the following general conditions:

1. The issuance of this permit shall not be deemed to affect in any way action by the Department of Environmental Protection of the State of New Jersey on any future application.

2. The works, facilities, and/or activities shown by plans and/or other engineering data, which are this day approved, subject to the conditions herewith established, shall be constructed and/or executed in conformity with such plans and/or engineering data and the said conditions.

3. No change in plans or specifications shall be made except with the prior written permission of the Department of Environmental Protection of the State of New Jersey.

4. The granting of this permit shall not be construed in any manner to constitute a Departmental determination on the ownership of property or any other legal responsibilities relating to the permittee or any other parties beyond the expressly stated conditions and limitations of this permit.

5. This permit does not waive the obtaining of Federal or other State or local government consent when necessary. This permit is not valid and no work shall be undertaken until such time as all other required approvals and permits have been obtained.

6. A copy of this permit shall be kept at the work site, and shall be exhibited upon request of any person.

7. This permit may be modified, suspended or terminated by the Department of Environmental Protection, after notice and hearing, for violations of any permit conditions, N.J.S.A. 58:1A-1 et seq., Subchapter 3 of N.J.A.C. 7:19-1 and 2 et seq., orders issued by the Department of Environmental Protection, and when deemed necessary for the public interest.

8. The permittee shall not transfer or assign this permit to any corporation or person without the consent of the Department of Environmental Protection. Any transfers of permits approved by the Department of Environmental Protection shall be made only for the identical use of water under the same terms and conditions as set forth in the transferred permit.

9. The permittee shall provide access to the Department of Environmental Protection to enter upon any facilities or other property required to properly inspect and monitor the diversion set forth in this permit.

10. Any violations of the conditions or terms of this permit shall subject the permittee to the penalties provided for in N.J.S.A. 58:1A-16.

MONITORING PLAN - QUARTERLY REPORT FACT SHEET

PERMIT #:

NAME:

CONTACT:

TELEPHONE:

TOTAL ALLOCATION: MILLION GALLONS/MONTH

GROUNDWATER DIVERSIONS - ALLOCATION:

HOW IS PUMPAGE MEASURED?

WELL PERMIT NO. GEOLOGIC FORMATION STATIC LEVEL MONITORING?

SURFACE WATER DIVERSIONS - ALLOCATION: MGM

STREAM NAME:

HOW IS PUMPAGE MEASURED?

MINIMUM FLOW REQUIREMENT?

OTHER PERMIT REQUIREMENTS:

STATIC WATER LEVELS: Measured by: tape; air-line and gauge; other?

Delay after pumping before measurements are taken:

CHLORIDE TEST: WHEN SAMPLE REQUIRED:

CHLORIDE CONCENTRATION: MG/L

MONITORING PLAN OF FILE:

CONSERVATION PLAN: REQUIRED? WHEN DUE?

IDENTIFICATION TAGS ON WELLS:

The usual means employed are the electric sounder method, the wetted tape method, and the air line method.

Perhaps the handiest device to use in most cases is the electric sounder or electrical depth gauge. This tool is available from several manufacturers. An electrode is suspended by a pair of insulated wires and an ammeter indicates a closed circuit and flow of current when the electrode touches the water surface. Flashlight batteries supply the current.

To improve the accuracy of readings, the electrode and cable should be left hanging in the well for a series of readings. This eliminates any errors from kinks or bends in the wires which may change the length slightly when the device is pulled up and let down. The change in water level should be measured along the cable with a steel tape, using one of the metal markers—which are commonly attached to the cable by the manufacturer at about 5-ft intervals—as a reference mark.

Wetted Tape Method

The wetted tape method is a very accurate way of measuring depth to water and can be used readily for depths up to 80 or 90 ft. First, a lead weight is attached to a steel measuring tape. The lower 2 or 3 ft of the tape is wiped dry and coated with carpenter's chalk or keel before making a measurement. The tape is let down in the well until a part of the chalked section is below water and one of the foot marks is held exactly at the top of the casing or at some other measuring point that may have been selected. The tape is then pulled up. The wetted line on the tape can be read to a fraction of an inch on the chalked section. This reading is subtracted from the foot-mark held at the measuring point, the difference then being the actual depth to the water level.

A disadvantage of this method is that the approximate depth to water must be known so that a portion of the chalked section will be submerged each time to produce a wetted line. Where the depth to water is more than 80 or 90 ft, the tape is difficult to handle. The accuracy of this method,

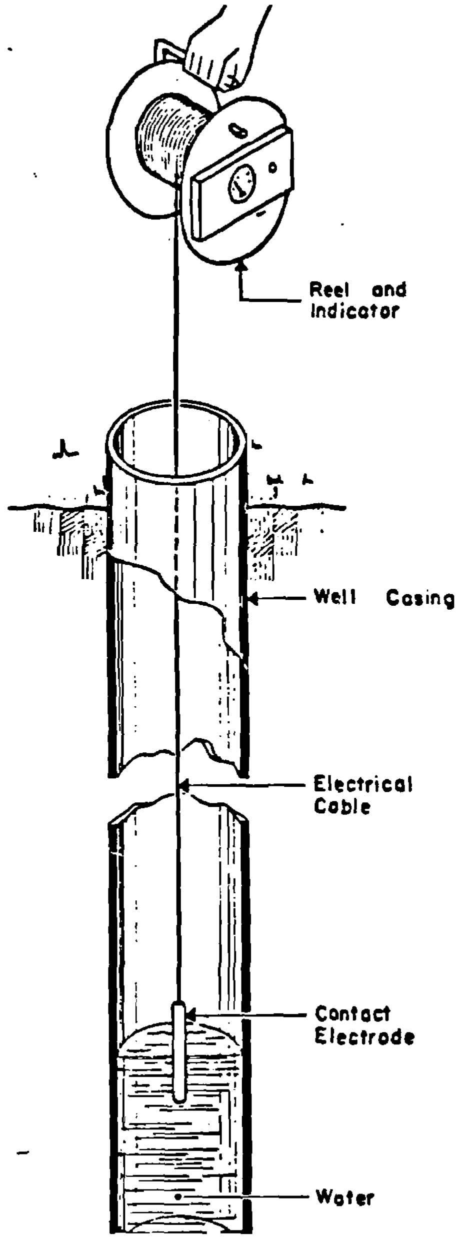


Figure 57. Electric sounder for measuring depth to water consists of electrode, two-wire cable and ammeter which indicates a closed circuit when electrode touches water.

however, exceeds that of other means for measuring depth to water.

Air Line Method

Figure 58 shows the installation of an air line in a well for the purpose of determining the depth to water. The air line consists of a small diameter pipe or tube of a length sufficient to extend from the top of the well to a point several feet below the lowest anticipated water level to be reached during the test. The exact length of the air line must be measured as it is placed in the well. If flexible tubing is used, steps must be taken to be sure that the tubing hangs vertically in the well and does not spiral inside the well casing. The air line must be completely air tight throughout its entire length and connections to it at the ground surface must be air tight.

Quarter-inch copper or brass tubing is commonly used for the air line. The upper end of the air line is fitted with suitable connections and valve so that an ordinary tire pump can be used to pump air into the tube. A tee is provided in the line to which a pressure gauge may be connected to measure the air pressure in the tube. A gauge calibrated to indicate pressure in feet of water serves better than one with a scale reading in pounds per square inch (psi).

The device works on the principle that the air pressure required to push all the water out of the submerged portion of the tube equals the water pressure of a column of water of that height. If this pressure is expressed in feet of water, the depth to water can be calculated.

A necessary first step is to determine accurately the depth from the top of the well casing or from some other reference point to the lower end of the air line. Once installed with the pressure gauge connected, air is then pumped into the air line. The pressure shown by the gauge increases until it reaches a maximum value which means that all the water has been forced out of the air line. At this point, the air pressure in the tube just balances the water pressure and the gauge reading shows the pressure necessary to support a column of water of a height equal to the distance from the water level in the well to the bottom of the tube. If the gauge indicates feet of water head, then it shows directly the submerged length of the air line in feet.

Subtracting the submerged length from the total length of the air line gives the depth to water below the measuring point chosen. A measurement made before starting to pump the well indicates the static water level.

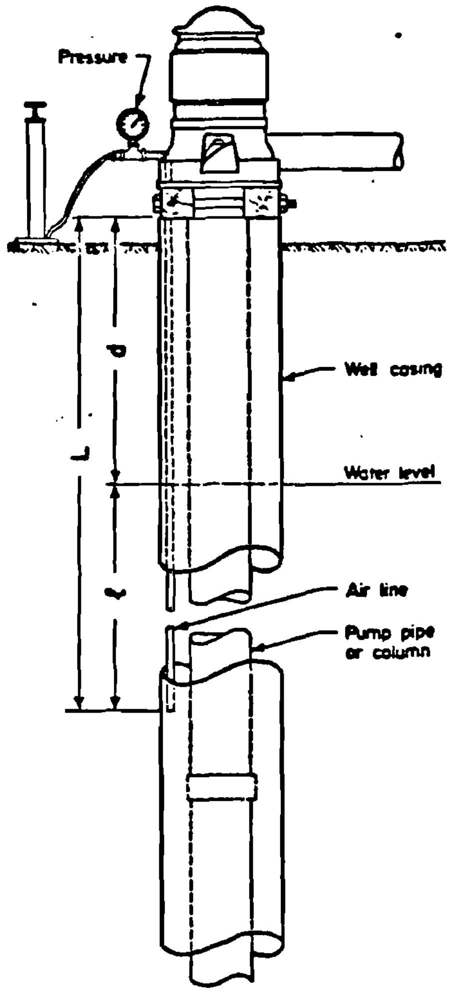


Figure 58. Typical installation for measuring water levels by air-line method.

Any change in water level is represented directly by a difference in pressure shown by the gauge in subsequent measurements. Drawdown during pumping and during recovery after pumping is stopped can be readily recorded from the pressure readings.

Referring to Figure 58, the depth to water is always calculated from the following formula:

$$d = L - l$$

where

- d is depth to water, in ft
- L is depth to bottom of air line, in ft
- l is pressure head, in ft, represented by a column of water of height equal to the submerged length of the air line.

Suppose we have an installation where the distance from the top of the well casing to the lower end of the air line is 95 ft. As air is pumped slowly into the line, assume that a maximum reading of 46 ft on the gauge is reached. The depth to water is then the difference between 95 and 46, or 49 ft. Let's say that this is the static water level.

Assume now that the pump is started. As the water level in the well drops, the submerged length of the air line decreases and the pressure indication on the gauge drops accordingly. A gauge reading of 34 ft, for example, would mean that the submerged length of the air line has decreased by 12 ft and the depth to water has changed to 95 minus 34, or 61 ft. This indicates a drawdown in the well of 12 ft below the static water level. If the gauge reads in psi, each reading must be multiplied by 2.31 to convert it to feet of water. A reading of 15 psi, for example, corresponds to a pressure head of 15 times 2.31, or 34.6 ft of water.

The dependability of the measurements made by the air line device varies with the accuracy of the pressure gauge and the care used each time in operating the tire pump to get the pressure reading. Depth to water can be determined usually within 0.2 ft of the exact value. The air line is not accurate enough for use in observation wells during an aquifer test, but it is the most practical means for measuring water levels in a pumped well. To avoid disturbances from turbulence near the intake of the pump, the lower end of the air line should be at least 5 ft above or below the point where water enters the pump.

Bill

Let's protect our earth

State of New Jersey
DEPARTMENT OF ENVIRONMENTAL PROTECTION
DIVISION OF WATER RESOURCES
CN 029
Trenton, N.J. 08625-0029

Office of the Director

(609) 292-1637
Fax # (609) 984-7938

JUL 23 1991

Mr. William Taetzsch
Environmental Coordinator
Exxon Company, U.S.A.
P.O. Box 222
Linden, N.J. 07036-0222

Dear Mr. Taetzsch:

RE: Extension of Comment Period
Exxon Company U.S.A. - Bayway Facility
Linden City, Union County
NJPDES No. NJ0001511

This is in response to your letter of July 12, 1991 regarding the subject facility.

The Department approves your request to extend the comment period for an additional 60 days until September 22, 1991. However, please be aware that any extension of the comment period will delay issuance of the final permit by at least a similar amount of time. Therefore, since the ultimate date for compliance with the limits to be established pursuant to the 304(l) initiatives is under the control of the U.S.E.P.A. and not the Department, the extension of the comment period may reduce the time period available for Exxon to come into compliance with any new final toxics limitations that may be established.

Should you have any questions, please contact Mr. Ben Manhas, the permit writer, at (609) 292-4860.

Sincerely,

Dennis Hart, Administrator
Wastewater Facilities Regulation Element

WFM195:rm

c: Robert Oberthaler, BIDP
Nancy Stiles, DAG

EXXON COMPANY, U.S.A.
POST OFFICE BOX 222 • LINDEN, NEW JERSEY 07036-0222

REFINING DEPARTMENT
BAYWAY REFINERY

July 26, 1989

Bayway Refinery Site Visit
and Tour of Morses Creek

Ms. Melisse Wilusz
Surface Water Permits Section
Bureau of Industrial Discharge Permits
Water Quality Management Element
Division of Water Resources
NJDEP
P. O. Box CN 029
Trenton, New Jersey 08625

RECEIVED
#723
JUL 31 1989
STATE OF NEW JERSEY
DEPT. ENVIRONMENTAL PROTECTION
DIVISION WATER RESOURCES
BUR. OF IND. WASTE MGMT.

Dear Ms. Wilusz:

This letter will confirm our 7/25/89 telephone conversation concerning your planned visit. The visit is scheduled for Thursday, August 24, at 10:00 a.m.

It is our understanding that the following NJDEP personnel will attend:

Mr. William Boehle	Ms. Cari Wild
Mr. Robert Oberthaler	Ms. Melisse Wilusz

If additional staff wish to attend, they are most welcome. If possible, I would appreciate it if you could notify me of additional people.

We hope this meeting will be informal and informative. The preliminary agenda is as follows:

- Background and History of Morses Creek
- Overview of Site Water Use
- Lunch
- Tour of Morses Creek
- Questions

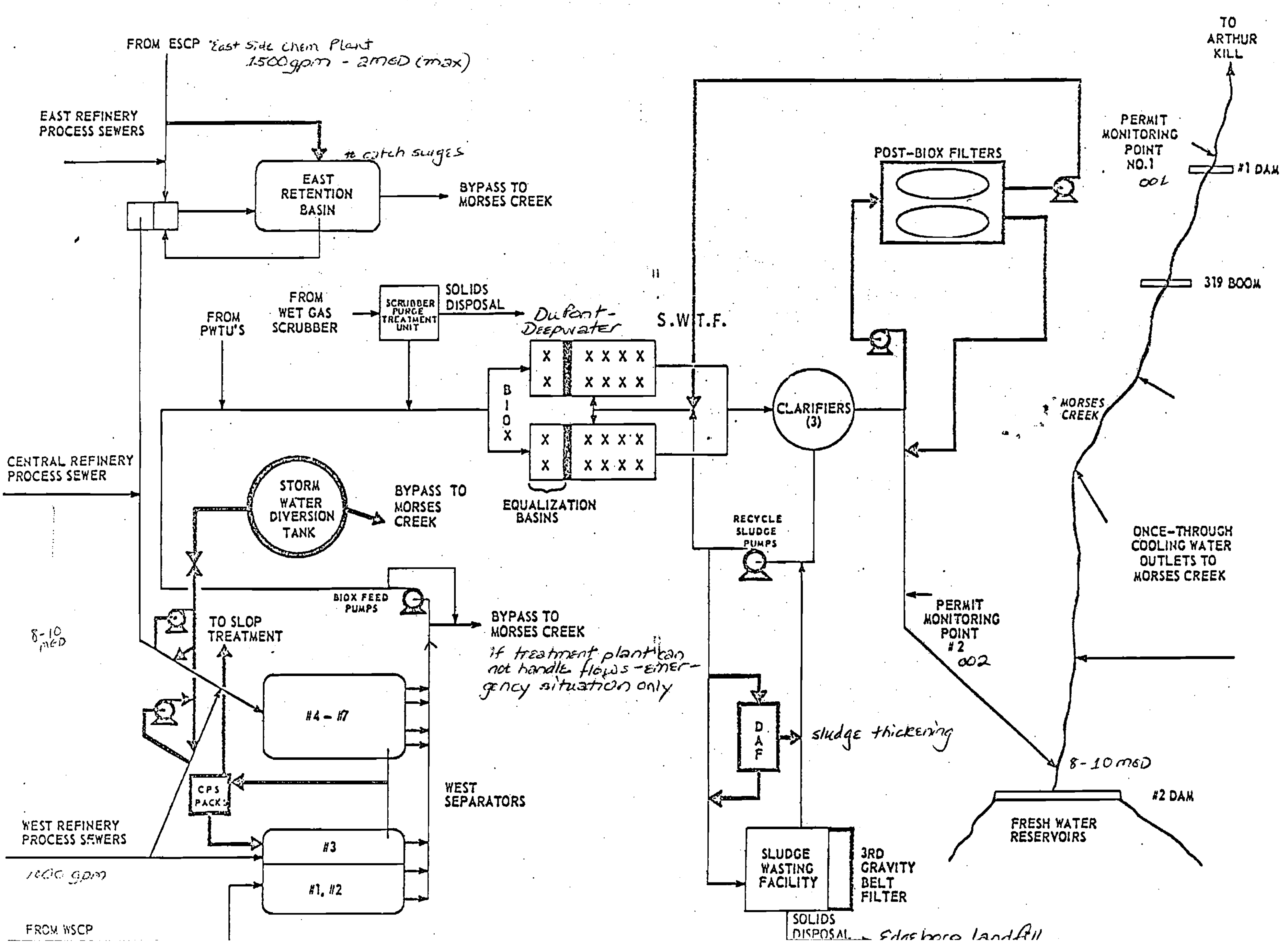
Special permission has been obtained for NJDEP personnel with facial hair to participate in the tour. Safety glasses with side shields, long sleeves, and hard hats will be required. Glasses and hard hats can be provided. We are looking forward to your visit. If you have any questions, please contact me at 201-474-7896.

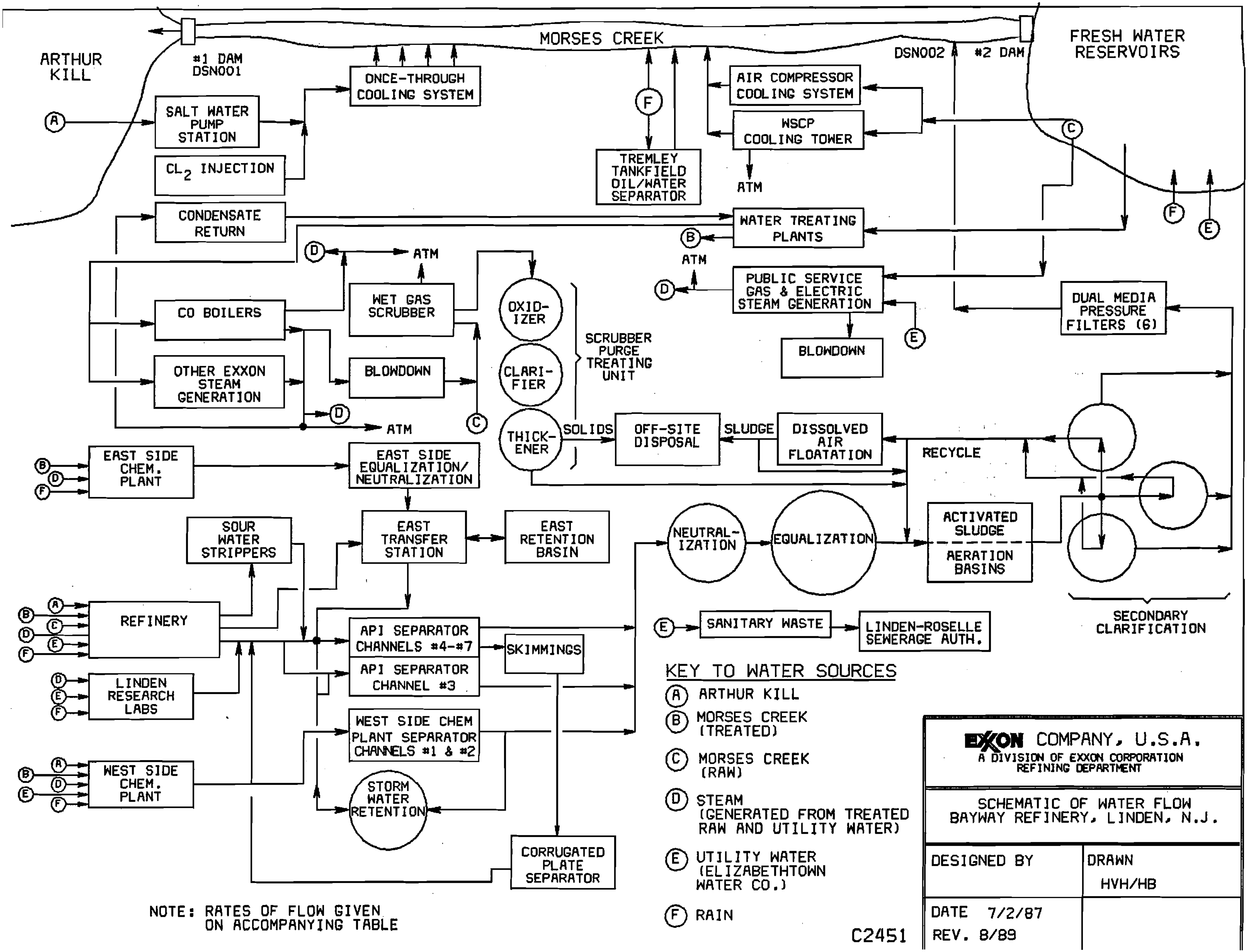
Very truly yours,

H. R. Van Handle
Senior Staff Engineer

HVH/dh
c: J. J. Carlin
W. L. Taetzsch
J. H. Takemoto

BAYWAY CONSERVATION FLOW PLAN




MORSES CREEK
ARTHUR KILL
#1 DAM DSN001
DSN002
#2 DAM
FRESH WATER RESERVOIRS
SALT WATER PUMP STATION
CL2 INJECTION
ONCE-THROUGH COOLING SYSTEM
TREMLEY TANKFIELD OIL/WATER SEPARATOR
AIR COMPRESSOR COOLING SYSTEM
WSCP COOLING TOWER
ATM
CONDENSATE RETURN
WATER TREATING PLANTS
CO BOILERS
WET GAS SCRUBBER
OXID-IZER
CLARI-FIER
THICK-ENER
SCRUBBER PURGE TREATING UNIT
PUBLIC SERVICE GAS & ELECTRIC STEAM GENERATION
BLOWDOWN
DUAL MEDIA PRESSURE FILTERS (6)
OTHER EXXON STEAM GENERATION
SOLIDS
OFF-SITE DISPOSAL
SLUDGE
DISSOLVED AIR FLOATATION
RECYCLE
EAST SIDE CHEM. PLANT
EAST SIDE EQUALIZATION/ NEUTRALIZATION
SOUR WATER STRIPPERS
EAST TRANSFER STATION
EAST RETENTION BASIN
NEUTRAL-IZATION
EQUALIZATION
ACTIVATED SLUDGE
AERATION BASINS
SECONDARY CLARIFICATION
REFINERY
API SEPARATOR CHANNELS #4-#7
API SEPARATOR CHANNEL #3
SKIMMINGS
SANITARY WASTE
LINDEN-ROSELLE SEWERAGE AUTH.
LINDEN RESEARCH LABS
WEST SIDE CHEM PLANT SEPARATOR CHANNELS #1 & #2
WEST SIDE CHEM. PLANT
STORM WATER RETENTION
CORRUGATED PLATE SEPARATOR
KEY TO WATER SOURCES
A ARTHUR KILL
B MORSES CREEK (TREATED)
C MORSES CREEK (RAW)
D STEAM (GENERATED FROM TREATED RAW AND UTILITY WATER)
E UTILITY WATER (ELIZABETHTOWN WATER CO.)
F RAIN
NOTE: RATES OF FLOW GIVEN ON ACCOMPANYING TABLE
C2451
EXXON COMPANY, U.S.A.
A DIVISION OF EXXON CORPORATION
REFINING DEPARTMENT
SCHEMATIC OF WATER FLOW
BAYWAY REFINERY, LINDEN, N.J.
DESIGNED BY
DRAWN
HVH/HB
DATE 7/2/87
REV. 8/89

MAP OF
BAYWAY REFINERY
BAYWAY REFINING COMPANY
A SUBSIDIARY OF TOSCO CORPORATION
CITY OF LINDEN
UNION COUNTY, N.J.
DATE AUG. 1955
SCALE
FIRST REVISION JULY 1959
SECOND REVISION JULY 1973
THIRD REVISION OCT. 1982
RIPARIAN GRANTS DEC. 1982
FOURTH REVISION OCT. 1984
FIFTH REVISION OCT. 1992
SITE DRAINAGE MAP
ATTACHMENT TO NPDES FORM 2F
APRIL 1, 1993
REV. 1 - MARCH 15, 1995
REV. 2 - SEPTEMBER 24, 1997
Master Drain Map
LEGEND:
OUTLINES DRAINAGE AREA FOR EACH OUTFALL
DENOTES PAVED AREAS & BLDGS WITHIN EACH DRAINAGE AREA
AREAS WHERE HERBICIDE IS APPLIED
ROSEDALE & LINDEN CEMETERY ASSOCIATION
ROSE HILL CEMETERY ASSOCIATION
MOUNT CALVARY CEMETERY
G. M. LINDEN AIRPORT
GENERAL MOTORS CORP.
RAHWAY RIVER TANK FIELD
CITY OF LINDEN DUMPS
BUCKEYE PIPELINE COMPANY
CITY OF LINDEN GARAGE
40 ACRE TANK FIELD
CITIES SERVICE OIL COMPANY'S TANKS
WATERFRONT TANK FIELD
SALT WATER PUMPING STATION
RAHWAY RIVER
ARTHUR KILL
STATEN ISLAND
NEW JERSEY TURNPIKE
U.S. ROUTE - NO. 1
U.S. ROUTE 1-278
ESSO RESEARCH & ENGINEERING CO.
AREA DRAINED BY OUTFALL S1
AREA DRAINED BY OUTFALL S6
AREA DRAINED BY OUTFALL S8
AREA DRAINED BY OUTFALL S9
AREA DRAINED BY OUTFALL S11
AREA DRAINED BY OUTFALL S12
AREA DRAINED BY OUTFALL S13
COOLING WATER DISCHARGE REGULATED UNDER NJPDES PERMIT #NJ0001511
NPS1
NPS2
NPS3
RE14
RE15
C001105

Annual Summary Report
1997
Rahway River Tank Field Separators
Bayway Refining Company
Linden, New Jersey

NJPDES-DGW Permit No. NJ 0087653

Prepared for:

Bayway Refining Company
1400 Park Avenue
Linden, New Jersey 07036

Attention: Mr. George Bakun

Prepared by:

CA Rich Consultants, Inc.
404 Glen Cove Avenue
Sea Cliff, New York 11579

April 16, 1998

TABLE OF CONTENTS

FIGURES

TABLES

APPENDICES

ANNUAL SUMMARY REPORT
1997
RAHWAY RIVER TANKFIELD SEPARATORS
BAYWAY REFINING COMPANY
LINDEN, NEW JERSEY

NJPDES-DGW PERMIT NO. NJ 0087653

1.0 INTRODUCTION

On behalf of Bayway Refining Company (BRC), CA Rich Consultants, Inc. (CA RICH) is pleased to submit this Annual Summary Report which reviews the groundwater quality characteristics at the Rahway River Tankfield Separators based on quarterly samples collected during 1997. A detailed discussion of the Rahway River Tankfield Separators site history, geology, hydrogeology, and historical groundwater sampling results since monitoring commenced in July 1991 was presented in the Annual Summary Report 1994 Rahway River Tankfield Separators, prepared by CA RICH and submitted by BRC to NJDEP on March 23, 1995.

All groundwater sampling was conducted in accordance with a New Jersey Pollutant Discharge Elimination System - Discharge to Ground Water (NJPDES-DGW) Permit No. NJ0087653.

1.1 Purpose

The purpose of this groundwater monitoring program is to determine if operation of the Rahway River Tankfield Separators impact local groundwater quality at this site. This report presents a general review of the Rahway River Tankfield Separators site history, geological and hydrogeological conditions, and an evaluation of the analytical groundwater quality results.

1.2 Background

The Rahway River Tankfield Separators site, located at the Bayway Refinery (Refinery) in Linden, New Jersey is situated southwest of the Refinery and is bordered by the Linden Municipal Landfill to the south and the Buckeye Pipeline Company to the east. The location of the Refinery and the Rahway River Tankfield Separators site are illustrated on Figures 1 and 2, respectively. A more detailed Site Plan of the Rahway River Tankfield Separators site is presented on Figure 3.

The Rahway River Tankfield is a bulk liquid storage facility containing twenty (20) above ground tanks used primarily for the storage of heating oil and gasoline produced at the Refinery. Two oil-water separators are presently in use at the Tankfield. The Separators are located on the southeast and southwest corners of the Tankfield and are designated Rahway River East and Rahway River West. The Separators receive drainage from a network of ditches designed to collect stormwater and surface water runoff throughout the Tankfield.

1.3 Site History

Aerial photographs taken in 1951 revealed that the Tankfield had not been constructed, however, development activity is evident to the north, south and east. The Tankfield is present in 1954 aerial photographs. The oil-water Separators had not been constructed, but a ditch draining into a body of water directly to the south is evident along the southwest corner of the Tankfield. By 1958, the Rahway River West Separator had been constructed, but the East Separator had not. The Rahway River East Separator is clearly visible in 1977 aerial photographs, with the Site appearing much the same as it does today (CA RICH, 1995).

2.0 GEOLOGY AND HYDROGEOLOGY

2.1 Geology

Based on available information, three (3) unconsolidated deposits underlie the Rahway River Tankfield Separators site. These units include: (1) fill materials; (2) Recent-age, alluvial deposits of clay, silt and sand; and (3) Pleistocene-age deposits of glacial till and glaciolacustrine green clay. These units are not laterally continuous.

2.2 Hydrogeology

All of the NJPDES monitoring wells at the Rahway River Tankfield Separator site are screened within the shallow water-table zone, which is primarily in the alluvial deposits of clay, silt and sand, and may also include areas of saturated fill material (CA RICH, 1995).

A summary of groundwater elevations since monitoring of the NJPDES wells commenced at the Tankfield is presented on Table 2. Based upon the observed groundwater elevation contours for each Separator for 1997 (see Figures 4 through 11), shallow groundwater flow direction at the West Separator is generally to the south with an estimated hydraulic gradient (dh/dl) ranging from 0.0015 to 0.0020 feet/feet (ft/ft). Monitoring well RR1S represents upgradient conditions from the West Separator. Groundwater flow direction at the East Separator is also generally to the south with an estimated hydraulic gradient ranging from 0.0040 to 0.0178 ft/ft. Monitoring well RR8S represents upgradient conditions from the East Separator.

A hydrograph for each monitoring well is provided in Appendix B. These graphs illustrate changes in water table elevation in response to seasonal fluctuations in precipitation and evapotranspiration. The fluctuating water elevations indicate the monitoring wells are suitably open to the aquifer and yield representative groundwater samples.

3.0 FIELD ACTIVITIES

3.1 Monitoring Well Installation

Between February and May 1991, NJPDES monitoring wells RR1S through RR8S were installed at the Tankfield. The locations of these wells are illustrated on Figure 3. A summary of the well construction specifications is presented on Table 1.

3.2 Hydraulic Testing

In-situ hydraulic test data indicate that the hydraulic conductivity (K) of the geologic formations beneath the Rahway River Tankfield Separators site ranges from 0.13 feet per day (ft/day) to 3.47 ft/day. The lowest K value was found at RR7S and the highest at RR2S (CA RICH, 1995).

3.3 Groundwater Sampling

Groundwater sampling was conducted at the Rahway River Tankfield Separators site by CA RICH on February 4, May 6, August 5, and November 4, 1997 in conformance with the Discharge to Ground Water Monitoring Sampling and Analysis Plan, prepared in January 1994. Sample collection and preservation forms for each sampling quarter are provided in Appendix A.

All monitoring wells were inspected prior to sampling for signs of damage and weathering. More frequent, routine inspections are also conducted by Refinery personnel. The visual inspection includes assessing the condition of concrete surface seals, presence of locks, and associated aboveground appurtenances. The condition of all monitoring wells was acceptable.

Well depths are measured during all sampling quarters. Most depths are equivalent to the measurements performed upon well installation (<0.3 feet change, or within the accuracy of the measurement technique), indicating that silt is not affecting the capacity of the wells to yield representative samples of groundwater.

All groundwater samples collected were transported for analysis to International Hydronics Corporation of Rocky Hill, New Jersey (NJ Certification No. 18086). During the second quarter sampling (May 1997) duplicate sample analysis for monitoring well RR1S was conducted by QC, Inc. of Southampton, Pennsylvania (NJ Certification No. 77166).

During all sampling months, the groundwater sample analysis included the following parameters:

- Volatile Organic Compounds plus 15 non-targeted peaks (VOC+15)
- Base Neutral Compounds plus 15 non-targeted peaks (BN +15)
- Petroleum Hydrocarbons
- Phenols
- Dissolved Metals (As, Ba, Cd, Cr, Cu, Fe, Pb, Mn, Hg, Se, Na, Zn)
- Total Metals (As, Ba, Cd, Cr, Cu, Fe, Pb, Mn, Hg, Se, Na, Zn)
- Hexavalent Chromium (Cr^{+6})
- Chloride (Cl)
- Sulfate (SO_4)
- Total Dissolved Solids (TDS)

Trip blanks, field banks and duplicate samples were also collected and analyzed for the above-listed parameters for each sampling quarter. In addition, pre-purge and post-purge field measurements for temperature, pH, dissolved oxygen, specific conductance, and salinity were collected at the time of sample collection (CA RICH, NJDEP Lab Certification No. 73001). A summary of analytical results and post-purge field measurements (pre-purge for dissolved oxygen) are presented on Tables 3 through 10.

4.0 DISCUSSION OF SAMPLING RESULTS

Summaries of compounds and constituents detected in at least one monitoring well during 1997 are presented on Tables 3 through 10. Summaries of all the parameters monitored since monitoring commenced for each respective monitoring well are provided in Appendix C.

The organic chemical compounds or inorganic constituents that have been detected in at least one sample from any one of the eight (8) monitoring wells during 1997 are summarized below. Compounds or constituents noted with an asterisk were also detected in method, trip, and/or field blanks at similar concentrations to those detected in well samples:

Base Neutral Compounds
acenaphthene
bis (2-ethylhexyl) phthalate*
fluorene
2-methylnaphthalene
dibenzofuran

Volatile Organic Compounds
benzene
methylene chloride*
trichlorofluoromethane*
acetone

Organic Compounds
phenols

Conventional Parameters
dissolved oxygen
pH
salinity
specific conductance
temperature

Metals
arsenic (total)
barium (total & dissolved)
cadmium (total & dissolved)
chromium (total)
copper (total & dissolved)
iron (total & dissolved)
lead (total)
manganese (total & dissolved)
sodium (total & dissolved)
zinc (total & dissolved)

Miscellaneous Compounds
chloride
sulfate
total dissolved solids (TDS)

4.1 Graphical and Linear Regression Analysis of Detected Analytes

Graphical concentration plots, when applicable, for each monitored parameter exceeding method detection limits were prepared for the following analytes (these graphs are provided in Appendix D):

Volatile Organic Compounds
benzene

Organic Compounds
phenols

Miscellaneous Compounds
chloride
sulfate
total dissolved solids (TDS)

Conventional Parameters
dissolved oxygen
pH
salinity
specific conductance
temperature

Metals
arsenic (total)
barium (total & dissolved)
cadmium (total & dissolved)
chromium (total)
copper (total & dissolved)
iron (total & dissolved)
lead (total)
manganese (total & dissolved)
sodium (total & dissolved)
zinc (total & dissolved)

Water quality trends were evaluated by means of linear regression analysis. In many instances in the historical record, individual analytes were not detected in consecutive sampling quarters (in other words, there were a mixture of detects and non-detects). When this occurred, the concentration assigned to a non-detect for purposes of the linear regression analysis was half the reported detection limit.

Appendix E presents a statistical analysis of selected compounds, constituents and parameters detected in 1997 in at least one sample from any groundwater monitoring well. The results of the graphical and linear regression analysis are provided in Table 11, and described below.

4.2 West Separator (RR1S, RR2S, RR3S and RR4S)

Benzene - During 1997, benzene was detected only in upgradient well RR1S at concentrations ranging from 2.0 µg/l (August) to 2.7 µg/l (May). The historic average concentration of benzene in RR1S is 5.9 µg/l. The benzene concentration in upgradient well RR1S has decreased by 103%.

Methylene Chloride - Methylene chloride was detected sporadically at low concentrations in well samples collected during the reporting period. Methylene chloride was also detected at comparable concentrations in the method, trip and/or field blanks. Consequently, methylene chloride is not considered to be present in the groundwater at this site. Given its continued presence in QA/QC blanks, the occurrence of methylene chloride is considered to be a laboratory contaminant and linear regression analysis is not applicable.

Trichlorofluoromethane - Trichlorofluoromethane was sporadically detected at low concentrations in well samples during February and August. Trichlorofluoromethane was also detected at comparable concentrations in the method, trip and/or field blanks when it was reported in well samples. Consequently, trichlorofluoromethane is not considered to be present in the groundwater at this site. Given its presence in QA/QC blanks, the occurrence of trichlorofluoromethane is considered to be a laboratory contaminant and linear regression analysis is not applicable.

Bis (2-ethylhexyl) phthalate - Bis (2-ethylhexyl) phthalate was detected sporadically, usually at low estimated concentrations in well samples collected during the reporting period. Bis (2-ethylhexyl) phthalate was also detected and reported at similar concentrations in trip and/or field blank samples during 1997. Based on the sporadic detections of bis (2-ethylhexyl) phthalate in the well samples, as well as in QA/QC blanks, the occurrence of bis (2-ethylhexyl) phthalate is considered to be a laboratory or field sampling introduced contaminant and linear regression analysis is not applicable.

2-Methylnaphthalene - During 1997, 2-methylnaphthalene was detected once, below the MDL, in upgradient well RR1S at an estimated concentration of 3.0 µg/l (May). Based on this one time low level occurrence, linear regression analysis is not applicable.

Phenols - During 1997, phenols were detected at concentrations near the MDL at least once in all wells monitoring the Rahway River West Separator. Average concentrations of phenols range from 21 µg/l (RR2S and RR4S) to 30 µg/l at upgradient well RR1S.

Arsenic - Arsenic (total) was detected at least once during the reporting at wells RR1S, RR3S and RR4S. The highest detection of total arsenic occurred in May at upgradient well RR1S (49.5 µg/l). Dissolved arsenic was not detected above MDLs in any of the wells.

Barium - Barium was detected once in May in upgradient well RR1S at 325 µg/l (total) and 152 µg/l (dissolved). The average barium concentration at well RR1S is 294 µg/l (total) and 176 µg/l (dissolved). Barium concentrations at well RR1S are decreasing (total) or stable (dissolved).

Chromium - Chromium (total) was detected at upgradient well RR1S at 27.7 µg/l (May). Chromium was not detected in the associated duplicate sample collected from RR1S. Based on this one time low level occurrence, linear regression analysis is not applicable.

Copper - Copper (total) was detected at least once in all wells during 1997 at concentrations ranging from 22 µg/l (November, RR1S) to 151 µg/l (November, RR4S). Copper (dissolved) was detected only at wells RR3S and RR4S at concentrations near the MDL of 20 µg/l. Overall, detections of copper have been infrequent and sporadic.

Iron - During 1997, iron (total and dissolved) was detected at least once in all wells at the Rahway River West Separator. Dissolved iron concentrations ranged from 0.148 mg/l in RR4S (May) to 3.0 mg/l in RR3S (August). Overall, iron concentrations appear to be stable.

Lead - During 1997, lead (total) was sporadically detected in samples collected from RR1S, RR2S and RR3S at concentrations ranging from 4.0 µg/l (RR1S) to 56 µg/l (RR2S). Dissolved lead was not detected during 1997. Based on the sporadic and discontinuous detections of lead in these wells historically, linear regression analysis is considered not applicable.

Manganese - Manganese was detected in all wells during 1997. Historical average concentrations of dissolved manganese range from 0.89 mg/l in RR4S to 13.1 mg/l in RR2S. Dissolved manganese concentrations appear to be stable in wells monitoring the Rahway River West Separator, with the exception of RR1S and RR2S where a decrease is observed.

Sodium - Sodium was detected in all wells during 1997. Historical average concentrations of dissolved sodium range from 42 mg/l in RR2S to 97 mg/l in RR4S. Sodium concentrations appear to be stable in all wells monitoring the Rahway River West Separator with only a slight increase observed at well RR4S.

Zinc - Zinc (total and dissolved) was detected sporadically during 1997. Detections of dissolved zinc ranged from 31 µg/l in well RR3S (August) to 43 µg/l at well RR4S (November). The historical average concentration of dissolved zinc is highest in upgradient well RR1S at 19.5 µg/l. Zinc concentrations appear to be stable in all wells monitoring the Rahway River West Separator.

Chloride - During 1997, the chloride levels in the wells monitoring the Rahway River West Separator have remained relatively consistent with historical concentrations, which have averaged between 53 mg/l in RR2S and 206 mg/l in RR4S. Chloride concentrations appear to be stable in all wells monitoring the Rahway River West Separator with only a slight increase observed at well RR4S.

Sulfate - During 1997, sulfate was detected in all wells monitoring the Rahway River West Separator. Historic average sulfate concentrations range from 99 mg/l in RR1S to 142 mg/l in RR3S. An increase in sulfate concentrations is observed for all wells monitoring the Rahway River West Separator.

Total Dissolved Solids (TDS) - During 1997, TDS concentrations in the wells monitoring the Rahway River West Separator have remained relatively consistent with historical concentrations, which have averaged between 474 mg/l in RR2S and 848 mg/l in RR4S. A slight increase is observed at well RR4S.

Dissolved Oxygen - During 1997, dissolved oxygen levels ranged from 1.50 mg/l in RR1S (August) to 5.45 mg/l in RR2S (November). Historically, average dissolved oxygen levels in all of the wells range from 3.2 mg/l in RR4S to 3.6 mg/l in RR3S.

pH - During 1997, pH values ranged from 6.43 standard units in RR4S (November) to 6.79 in RR3S (February). Historically, average pH values in all of the wells range between 6.21 in RR2S and 6.79 in RR1S.

Salinity - Typical salinity concentrations range from less than 1.0 part per thousand (ppt) in wells RR1S, RR2S and RR3S to 2.0 ppt in RR4S.

Specific Conductance - During 1997, specific conductance levels in the wells monitoring the Rahway River West Separator have remained relatively consistent with historical concentrations, which have averaged between 683 micromhos per centimeter (µmhos/cm) in RR3S to 1,063 µmhos/cm in RR1S.

Temperature - During 1997, groundwater temperature ranged from 11 degrees Celsius (°C) in February to 18 °C in August. The temperature of groundwater at the Rahway River West Separator averages about 15 °C.

4.3 East Separator (RR5S, RR6S, RR7S and RR8S)

Benzene - During 1997, benzene was detected only in upgradient well RR8S at a concentration of 2.0 µg/l (May). Benzene was not detected in any other well at the Rahway River East Separator during the reporting period. Based upon the infrequent and sporadic detections of benzene, only in upgradient well RR8S, linear regression analysis is not applicable.

Methylene chloride - Methylene chloride was detected sporadically at low concentrations in well samples collected during the reporting period. Methylene chloride was also detected at comparable concentrations in the method, trip and/or field blanks. Consequently, methylene chloride is not considered to be present in the groundwater at this site. Given its continued presence in QA/QC blanks, the occurrence of methylene chloride is considered to be a laboratory contaminant and linear regression analysis is not applicable.

Trichlorofluoromethane - Trichlorofluoromethane was detected at 1.0 µg/l in well RR6S during August. Trichlorofluoromethane was also detected at 3.0 µg/l in the trip blank during August. Consequently, trichlorofluoromethane is not considered to be present in the groundwater at this site. Given its presence in QA/QC blanks, the occurrence of trichlorofluoromethane is considered to be a laboratory contaminant and linear regression analysis is not applicable.

Acenaphthene - Acenaphthene was detected below the MDL twice (February and August) in upgradient well RR8S at an estimated concentration of 1.0 µg/l. Based upon the infrequent occurrence of acenaphthene, linear regression analysis is not applicable.

Bis (2-ethylhexyl) phthalate - Bis (2-ethylhexyl) phthalate was detected sporadically, usually at low estimated concentrations in well samples collected during the reporting period. Bis (2-ethylhexyl) phthalate was also detected and reported at similar concentrations in trip and/or field blank samples during 1997. Based on the sporadic detections of bis (2-ethylhexyl) phthalate in the well samples, as well as in QA/QC blanks, the occurrence of bis (2-ethylhexyl) phthalate is considered to be a laboratory or field sampling introduced contaminant and linear regression analysis is not applicable.

Fluorene - During 1997, fluorene was detected below the MDL, at estimated concentrations, three times in upgradient well RR8S. Based upon the infrequent and sporadic occurrence of fluorene below the MDL, linear regression analysis is not applicable.

Dibenzofuran - During 1997, dibenzofuran was detected once, below the MDL, in upgradient well RR8S at an estimated concentration of 1.0 µg/l (August). Based on this one-time low level occurrence, linear regression analysis is not applicable.

Phenols - During 1997, phenols were detected in wells RR6S, RR7S and RR8S at concentrations near the MDL. The average concentration of phenols for all wells at the Rahway River East Separator is about 21 µg/l. Based on the infrequent and discontinuous occurrence of phenols in wells at the Rahway River East Separator, linear regression analysis is not applicable.

Arsenic - During 1997, arsenic (total) was detected once at RR5S in May at a concentration of 36 µg/l. Dissolved arsenic was not detected above MDLs in any of the wells at the Rahway River East Separator.

Cadmium - Cadmium (total) was detected only at well RR7S during the reporting period at concentrations ranging from 12 µg/l to 16 µg/l. Dissolved cadmium was detected once at well RR7S at a concentration of 11 µg/l. Historically, cadmium has been detected sporadically only at well RR7S at concentrations that average 54 µg/l (total) and 3.7 µg/l (dissolved).

Copper - Copper (total) was detected once in well RR5S at 32 µg/l and once at RR8S at 26 µg/l. Total copper was also detected at RR7S at concentrations of 24 µg/l and 78 µg/l. Dissolved copper was not detected above MDLs in any of the samples collected from the wells monitoring the Rahway River East Separator.

Iron - Iron (total) was detected in all wells at concentrations ranging from 0.26 mg/l in RR5S to 33 mg/l in RR8S. Iron concentrations appear stable in all wells with only a slight increase observed at well RR8S. Dissolved iron concentrations are only observed in upgradient well RR8S at an average concentration of 7.4 mg/l.

Lead - Lead (total) was detected once at well RR7S (15 µg/l) and once at upgradient well RR8S (2 µg/l). Total lead is detected most frequently at RR7S where a decrease in concentration is observed. Dissolved lead was not detected in any of the wells monitoring the Rahway River East Separator.

Manganese - Manganese (total) was detected in all well samples during 1997. Historical average concentrations of dissolved manganese range from 0.2 mg/l in RR6S to 14 mg/l in RR8S. Dissolved manganese concentrations appear to be stable, with only a slight increase observed in RR8S.

Sodium - Sodium was detected in all well samples during 1997. Historical average concentrations of dissolved sodium range from 6.4 mg/l in RR7S to 20 mg/l in RR5S. Sodium concentrations appear to be stable in all of the wells monitoring the Rahway River East Separator.

Zinc - Zinc (total and dissolved) was sporadically detected during 1997 in wells RR5S, RR6S (total only) and RR7S. Detections of total zinc ranged from 21 µg/l at well RR5S to 157 µg/l at well RR7S. Dissolved concentrations of zinc detected most frequently at RR7S ranged from 33 µg/l to 157 µg/l. Zinc concentrations appear to be stable in all wells.

Chloride - During 1997, the chloride levels in the wells monitoring the Rahway River East Separator have remained relatively consistent with historical concentrations, which have averaged between 6.7 mg/l in RR5S and 11.7 mg/l in RR7S.

Sulfate - During 1997, sulfate was detected in all wells monitoring the Rahway River East Separator. Average sulfate concentrations range from 35.5 mg/l in RR8S to 107 mg/l in RR7S.

Total Dissolved Solids (TDS) - During 1997, TDS concentrations in the wells monitoring the Rahway River East Separator have remained relatively consistent with historical concentrations, which have averaged between 150 mg/l in RR7S and 337 mg/l in RR5S.

Dissolved Oxygen - During 1997, dissolved oxygen levels ranged from 1.80 in RR8S (November) to 4.38 in RR5S (May). Historically, average dissolved oxygen levels in all of the wells range between 3.52 mg/l in RR8S and 5.11 mg/l in RR5S.

pH - During 1997, pH values ranged from 5.47 standard units in RR6S (August) to 6.52 in RR8S (August). Historically, average pH values in all of the wells range between 6.07 in RR6S and 6.49 in RR8S.

Salinity - During 1997, salinity was detected only at RR5S at 0.3 parts per thousand (ppt). Historically, salinity is not typically detected in wells monitoring the Rahway River East Separator.

Specific Conductance - During 1997, specific conductance levels in the wells monitoring the Rahway River East Separator have remained relatively consistent with historical concentrations, which have averaged between 155 micromhos per centimeter (µmhos/cm) in RR7S and 439 µmhos/cm in RR5S.

Temperature - During 1997, groundwater temperature ranged from 11 °C in February to 18 °C in August. The temperature of groundwater at the Rahway River East Separator averages about 15 °C.

5.0 SUMMARY AND CONCLUSIONS

5.1 General

This report reviews the groundwater quality characteristics at the Rahway River Tankfield Separators site during 1997 based on samples collected quarterly from February through November. A more comprehensive, historical review of the groundwater quality characteristics at the Rahway River Tankfield Separators site was presented in the Annual Summary Report 1994 Rahway River Tankfield Separators, prepared by CA RICH and submitted by BRC to NJDEP on March 23, 1995.

The Rahway River Tankfield is a bulk liquid storage facility containing twenty (20) above ground tanks primarily used for the storage of heating oil and gasoline produced at the Refinery. The Separators are located on the southeast and southwest corners of the Tankfield. The Separators receive drainage from a network of ditches designed to collect stormwater and surface water runoff throughout the Tankfield.

Groundwater sampling was conducted at the Rahway River Tankfield Separators site by CA RICH on February 4, May 6, August 5, and November 4, 1997 in conformance with the Discharge to Ground Water Monitoring Sampling and Analysis Plan, prepared in January 1994.

5.2 Organic Compounds

Volatile organic compounds detected at least once in the groundwater samples collected from the Rahway River Tankfield Separators wells include benzene, trichlorofluoromethane, acetone and methylene chloride.

During 1997, sporadic detections of benzene were generally reported at concentrations near or below MDLs only at upgradient well locations (RR1S and RR8S). Sporadic detections of trichlorofluoromethane, acetone and methylene chloride were also reported, however, since these compounds were also detected at similar concentrations in field and/or trip blanks, they are considered to be laboratory contaminants.

Volatile organic compounds detected in samples collected during 1997 have been generally reported at low estimated concentrations below the MDL and can either be attributed to possible historic contamination upgradient of the Separators and/or possible laboratory and/or field introduced contamination. The presence of volatile organic compounds in samples collected during 1997 is not related to the operation of the Separators.

Detections of base neutral compounds in samples collected during 1997 were generally reported at low estimated concentrations below MDLs. The one or two time detections of acenaphthene, fluorene, 2-methylnaphthalene and dibenzofuran were all reported below MDLs. Detections of fluorene, all estimated below MDLs, have only been infrequently observed in upgradient well RR8S. Bis (2-ethylhexyl) phthalate was detected sporadically during 1997, but was also detected in trip and field blanks during the reporting period and is considered to be a field or laboratory contaminant.

Base neutral compounds detected in samples collected during 1997 have been generally reported at low estimated concentrations below MDLs and can be either attributed to possible historic contamination upgradient of the Separators and/or possible laboratory and/or field introduced contamination. The presence of base neutral compounds in samples collected during 1997 is not related to the operation of the Separators.

Sporadic low level detections of phenols were reported in upgradient and downgradient wells alike during 1997. The detection of phenols in wells upgradient of the Separators indicates possible historic contamination not related to the operation of the Separators.

5.3 Inorganic Constituents

Metals (total and/or dissolved) detected in at least one groundwater sample collected during the reporting period include arsenic, barium, cadmium, chromium, copper, iron, lead, manganese, sodium, and zinc. Of these constituents, observed concentrations of iron, manganese, sodium and zinc are considered to reflect naturally occurring levels for groundwater in this environmental setting.

Based upon historical information and lab data, QA/QC sample results, detections in upgradient wells, and comparison of total and dissolved metal analysis, detections of barium, cadmium, chromium, copper and lead during 1997 do not represent a potential release from the Separators. The infrequent and sporadic detections of these constituents, usually at low concentrations near the MDL, can be attributed to other factors affecting groundwater samples at the Rahway River Tankfield.

5.4 Miscellaneous

Chloride, TDS, salinity and specific conductance were detected/measured in groundwater samples collected during 1997. The levels in the wells monitoring the groundwater at the Rahway River Tankfield Separators reflect ambient water quality, suggesting that fresh water prevails in the aquifer. A temporary observed increase in the levels of sodium, chloride and TDS at some of the wells has been attributed to the application of road salts during winter months, since the concentrations of these constituents have returned to more typical levels in 1997.

Sulfate, dissolved oxygen, temperature and pH are within expected tolerances for groundwater in this environmental setting. The observed levels of these parameters do not reflect a release from the Separators.

Based upon the water quality analysis in 1997, there have been no releases from the Rahway River Tankfield Separators. Compounds and constituents detected in the groundwater samples can be either attributed to historical contamination, laboratory or field contamination, and/or natural background levels unrelated to the operation of the Separators.

Therefore, CA RICH concludes the following:

1. Volatile organic and base neutral extractable compounds detected in groundwater samples for the reporting period are generally not detected at significant levels and their presence is not indicative of a potential release from the Separators. These compounds have generally been detected at similar or higher levels in upgradient wells relative to downgradient wells. Also, when some of the volatile organic compounds were reported in well samples, they were also detected in QA/QC blanks indicating possible laboratory and/or field introduced contamination.

2. The detection of metal constituents in groundwater samples during 1997 can generally be attributed to naturally occurring, background levels and/or other factors affecting groundwater samples unrelated to the operation of the Separators.

3. Observed concentrations of chloride, TDS, sulfate, specific conductance, and salinity reflect ambient water quality conditions expected to occur in this environmental setting.

4. Observed concentrations or measurements of dissolved oxygen, pH and temperature are within the expected tolerances for groundwater given this environmental setting.

6.0 RECOMMENDATIONS

1. Based upon the continued absence, or sporadic low-level detections, of volatile organic and base neutral extractable compounds in groundwater samples collected at the Rahway River Tankfield Separators site, CA RICH recommends continued quarterly monitoring only for BTEX compounds and total petroleum hydrocarbons, in addition to all field parameters. These parameters would be most indicative of a gasoline or heating oil release, which are the primary petroleum products stored at the Tankfield.

2. Given the continued absence, or sporadic low-level detections of arsenic, cadmium, copper, chromium, hexavalent chromium, lead, mercury, selenium, zinc and phenols, these parameters should be deleted from the parameter list.

3. CA RICH recommends the sampling frequency of the following parameters be reduced from quarterly to annually: barium, iron, manganese, sodium, chloride, sulfates and total dissolved solids. These parameters have been detected in samples collected from at least one well, but have been attributed to natural causes and/or historic contamination. Continued monitoring at a reduced frequency is recommended to identify any long term changes to groundwater quality conditions.

CA RICH appreciates this opportunity to present cumulative results of quarterly groundwater monitoring during the reporting year 1997 at the Rahway River Tankfield Separator Site for the Bayway Refining Company. If there are questions, or need for additional detail, please feel free to contact either undersigned, immediately.

Respectfully submitted,

CA RICH CONSULTANTS, INC.

Steven Sobstyl
Project Manager

Charles A. Rich, CPG #4433
President

AMERICAN INSTITUTE OF PROFESSIONAL GEOLOGISTS
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4433
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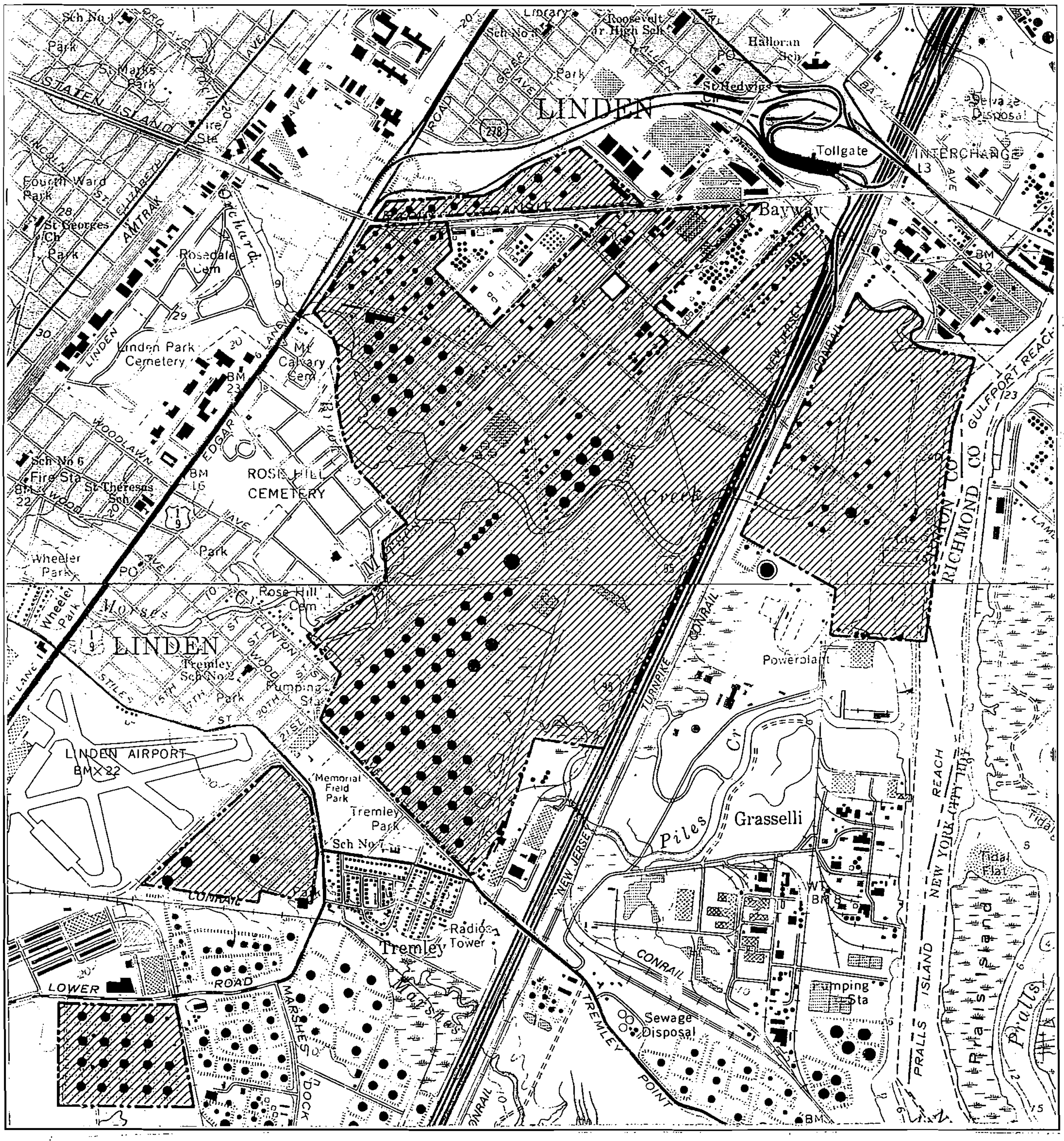
Users:Steve/Projects/Bayway/Rahway/1996/Rahway@Report 1997

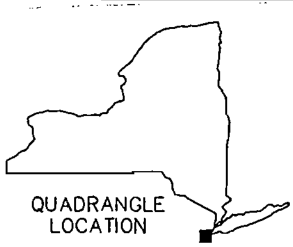
REFERENCES

CA RICH; Annual Summary Report 1994 Rahway River Tankfield Separators; Bayway Refining Company, Linden, New Jersey, March 1995.

FIGURES



Revised by CA RICH March 1996



N
W E
S

0 250 500 750 1000 1500 2000

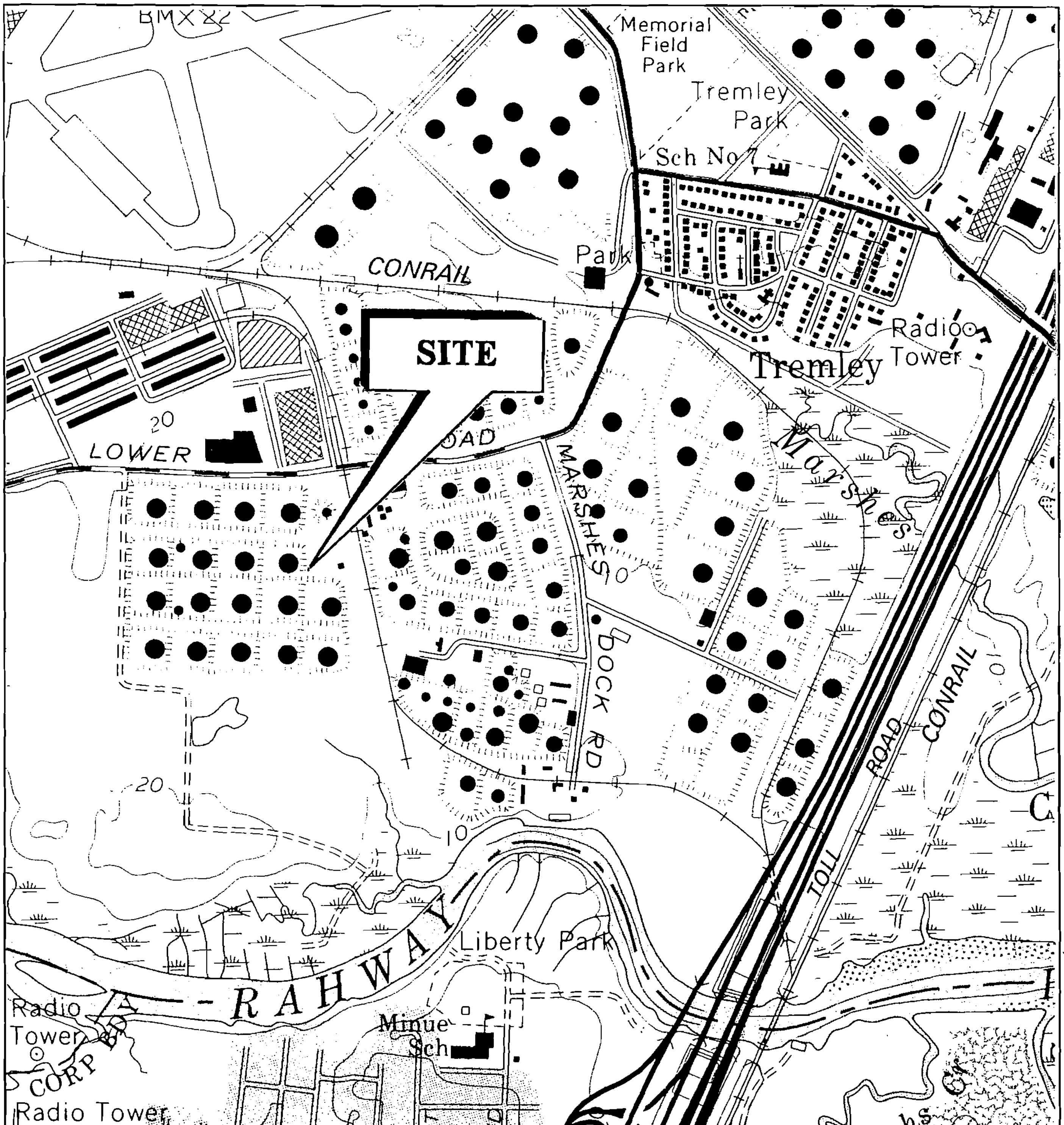
Scale in Feet

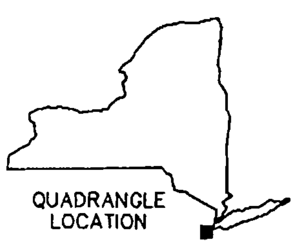
SOURCE: USGS TOPOGRAPHIC MAPS – ELIZABETH, NJ/ARTHUR KILL, NY QUADRANGLES DATED 1967/1966; PHOTOREVISED 1981

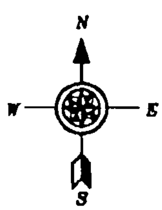
CA RICH CONSULTANTS, INC.

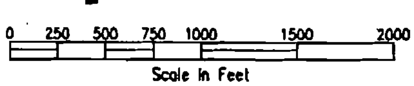
Certified Ground–Water and Environmental Specialists
404 Glen Cove Avenue, Sea Cliff, NY 11579

TITLE: LOCATION OF BAYWAY REFINING COMPANY		DATE: 9/13/94
		SCALE: AS SHOWN
FIGURE: 1	REFINERY LOCATION BAYWAY REFINING COMPANY LINDEN, NEW JERSEY	DRAWN BY: J.J.S.
DRAWING NO: 3219-01A.8		APPR. BY: T.R.H.









SOURCE: USGS TOPOGRAPHIC MAP – ARTHUR KILL, NY-NJ QUADRANGLE 1966; PHOTOREVISED 1981

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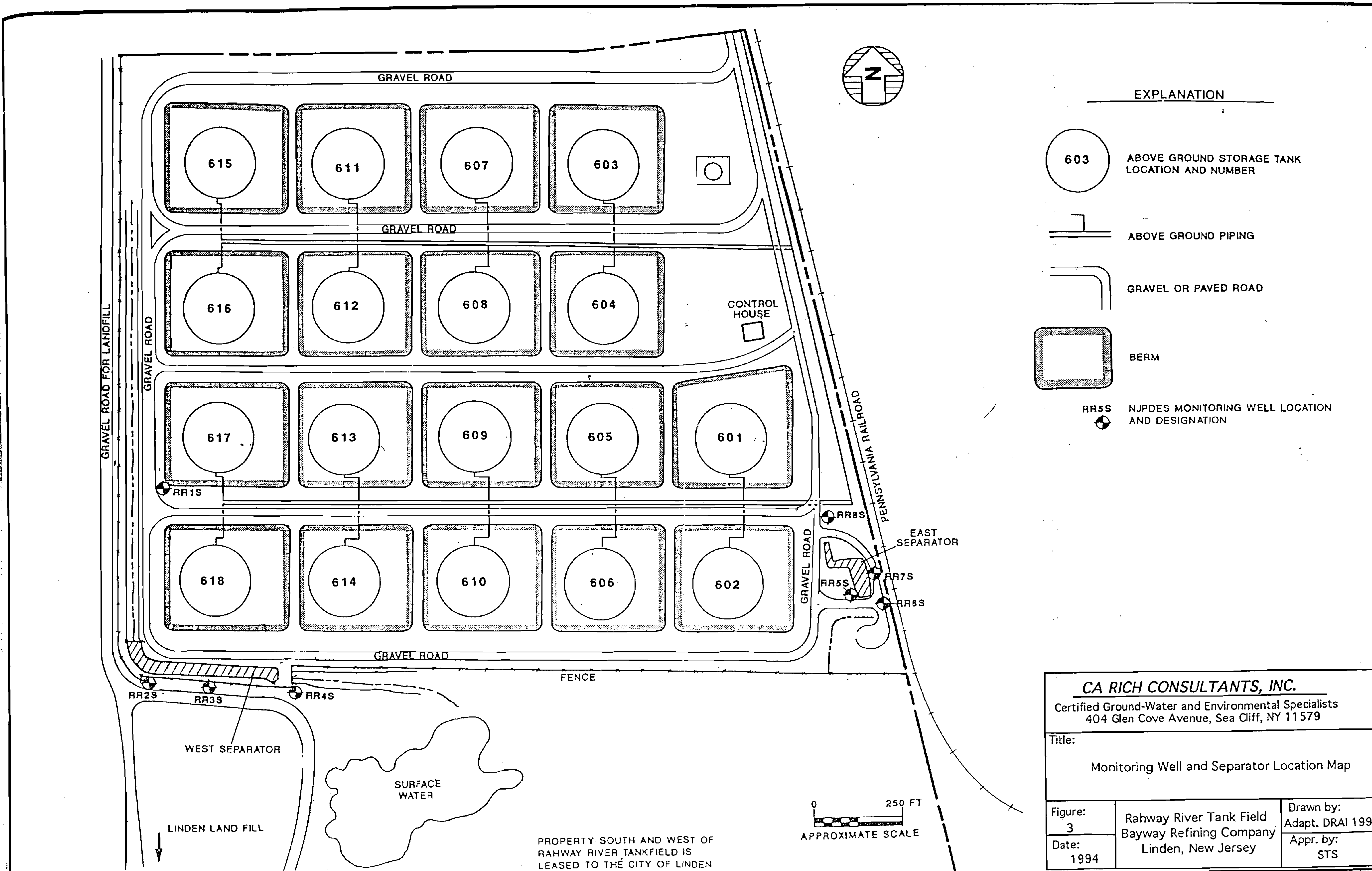
TITLE: SITE LOCATION MAP		DATE: 3/21/94
		SCALE: AS SHOWN
FIGURE: 2	RAHWAY RIVER TANK FIELD BAYWAY REFINING COMPANY LINDEN, NEW JERSEY	DRAWN BY: J.J.S.
DRAWING NO: 3219-01A.1		APPR. BY: T.R.H.



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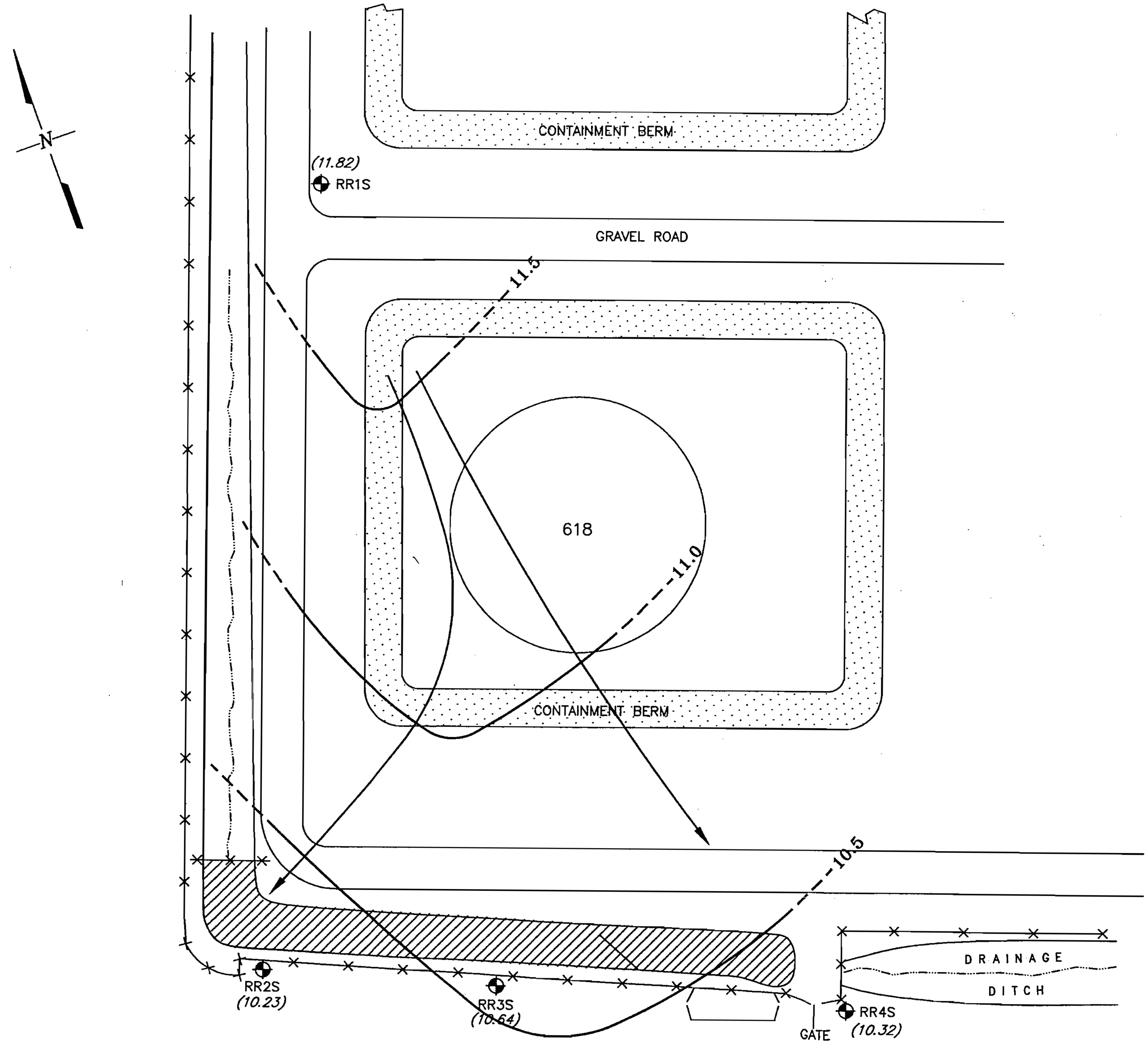
Title: Monitoring Well and Separator Location Map

Figure: 3	Rahway River Tank Field Bayway Refining Company Linden, New Jersey	Drawn by: Adapt. DRAI 1994
Date: 1994		Appr. by: STS



KEY

FENCE

EXISTING SEPARATOR

618 ABOVE GROUND STORAGE TANK

RR1S MONITORING WELL

(11.82) GROUNDWATER ELEVATION IN FEET ABOVE MEAN SEA LEVEL

10.50 GROUNDWATER ELEVATION CONTOUR IN FEET ABOVE MEAN SEA LEVEL (DASHED WHERE INFERRED)

GENERAL GROUNDWATER FLOW DIRECTION

0 40 80 120 160

Scale in Feet

CONTOUR INTERVAL: 0.5 FEET

NO.	DESCRIPTION	DATE	APPV.
	REVISIONS		

CA RICH CONSULTANTS, INC.

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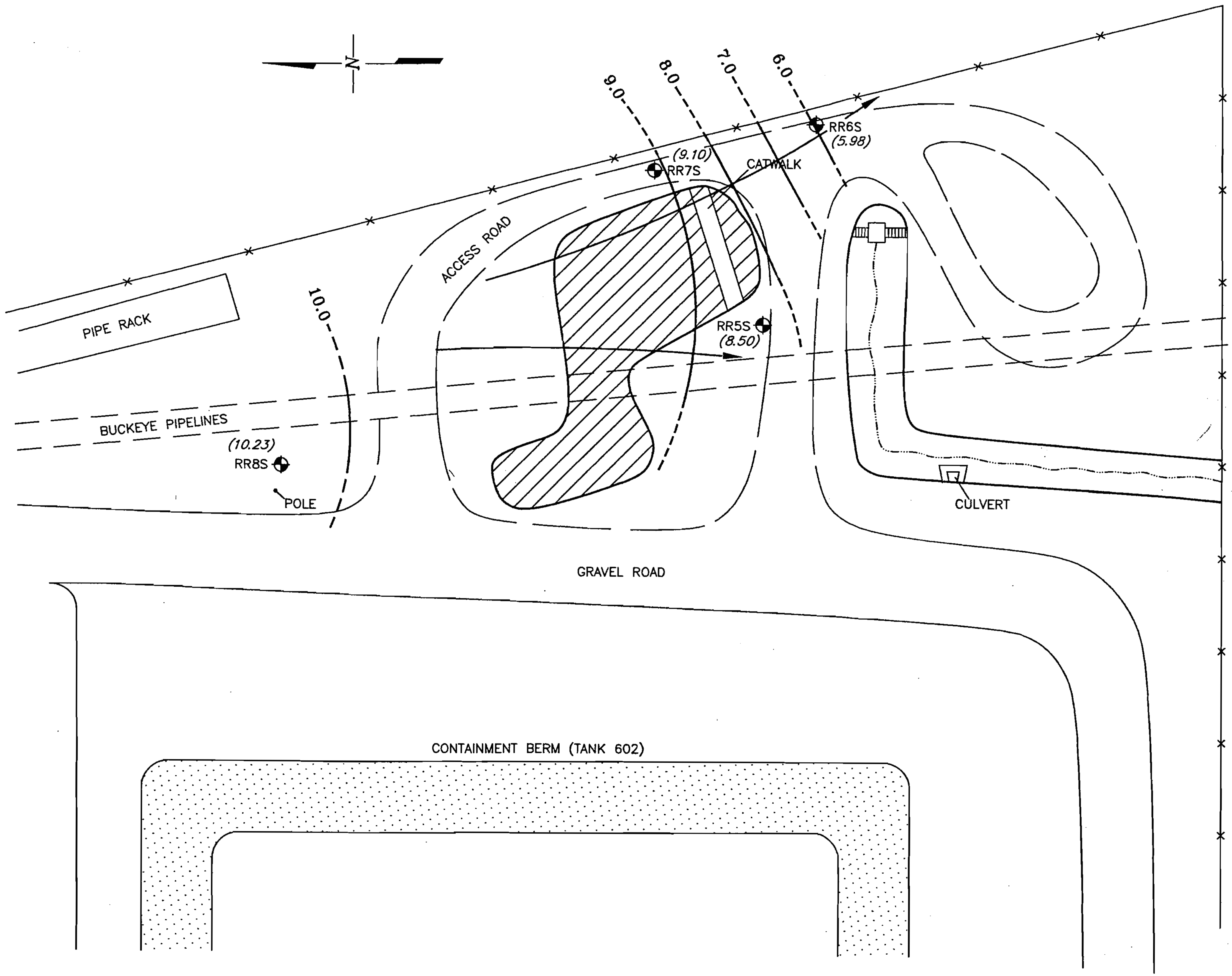
404 Glen Cove Avenue, Sea Cliff, NY 11579

TITLE: GROUNDWATER ELEVATION CONTOUR MAP FEBRUARY 4, 1996		DATE: 2/20/97
		SCALE: AS SHOWN
FIGURE: 4	RAHWAY RIVER (WEST) BAYWAY REFINING COMPANY LINDEN, NEW JERSEY	DRAWN BY: C.G./J.J.S.
DRAWING NO: 3219-01H.14		APPR. BY: S.T.S.



KEY

DRAINAGE DITCH

FENCE

EXISTING SEPARATOR

RR8S MONITORING WELL

(8.50) GROUNDWATER ELEVATION IN FEET ABOVE MEAN SEA LEVEL

9.0 GROUNDWATER ELEVATION CONTOUR IN FEET ABOVE MEAN SEA LEVEL (DASHED WHERE INFERRED)

GROUNDWATER FLOW DIRECTION

0 20 40 60 80

Scale in Feet

CONTOUR INTERVAL: 1.0 FEET

NO.	DESCRIPTION	DATE	APPV.

REVISIONS

CA RICH CONSULTANTS, INC.

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404 Glen Cove Avenue, Sea Cliff, NY 11579

TITLE: GROUNDWATER ELEVATION CONTOUR MAP FEBRUARY 4, 1997

DATE: 2/19/97

SCALE: AS SHOWN

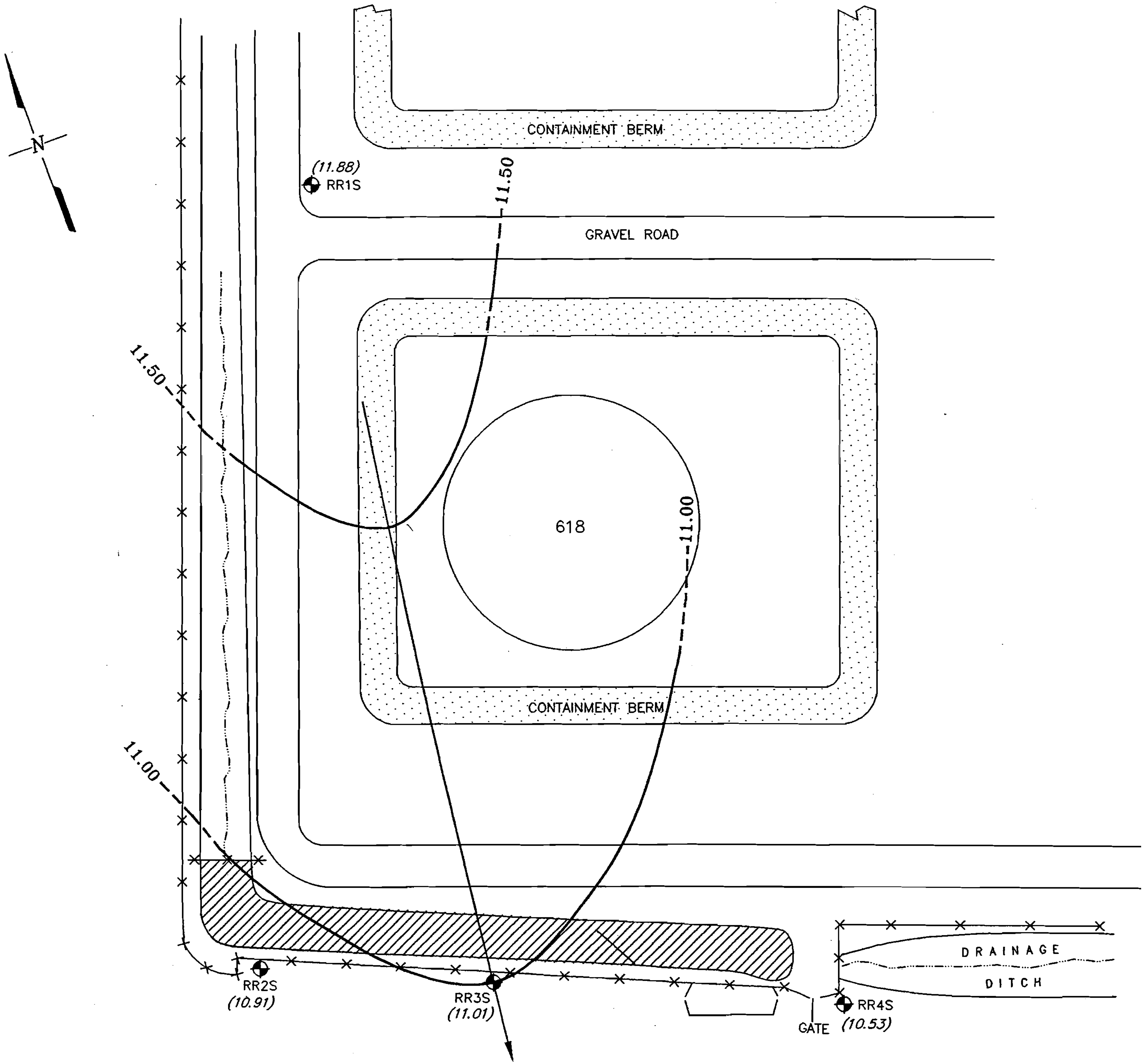
FIGURE: 5

DRAWING NO: 3219-01G.14

RAHWAY RIVER (EAST)
BAYWAY REFINING COMPANY
LINDEN, NEW JERSEY

DRAWN BY: C.G./J.J.S.

APPR. BY: S.T.S.



KEY

FENCE

EXISTING SEPARATOR

618 ABOVE GROUND STORAGE TANK

RR1S MONITORING WELL

(10.34) GROUNDWATER ELEVATION IN FEET ABOVE MEAN SEA LEVEL

10.50 GROUNDWATER ELEVATION CONTOUR IN FEET ABOVE MEAN SEA LEVEL (DASHED WHERE INFERRED)

GENERAL GROUNDWATER FLOW DIRECTION

0 40 80 120 160

Scale in Feet

CONTOUR INTERVAL: 0.50 FEET

NO.	DESCRIPTION	DATE	APPV.

REVISIONS

CA RICH CONSULTANTS, INC.

Certified Ground-Water and Environmental Specialists
404 Glen Cove Avenue, Sea Cliff, NY 11579

TITLE: GROUNDWATER ELEVATION CONTOUR MAP MAY 6, 1997

DATE: 5/20/97

SCALE: AS SHOWN

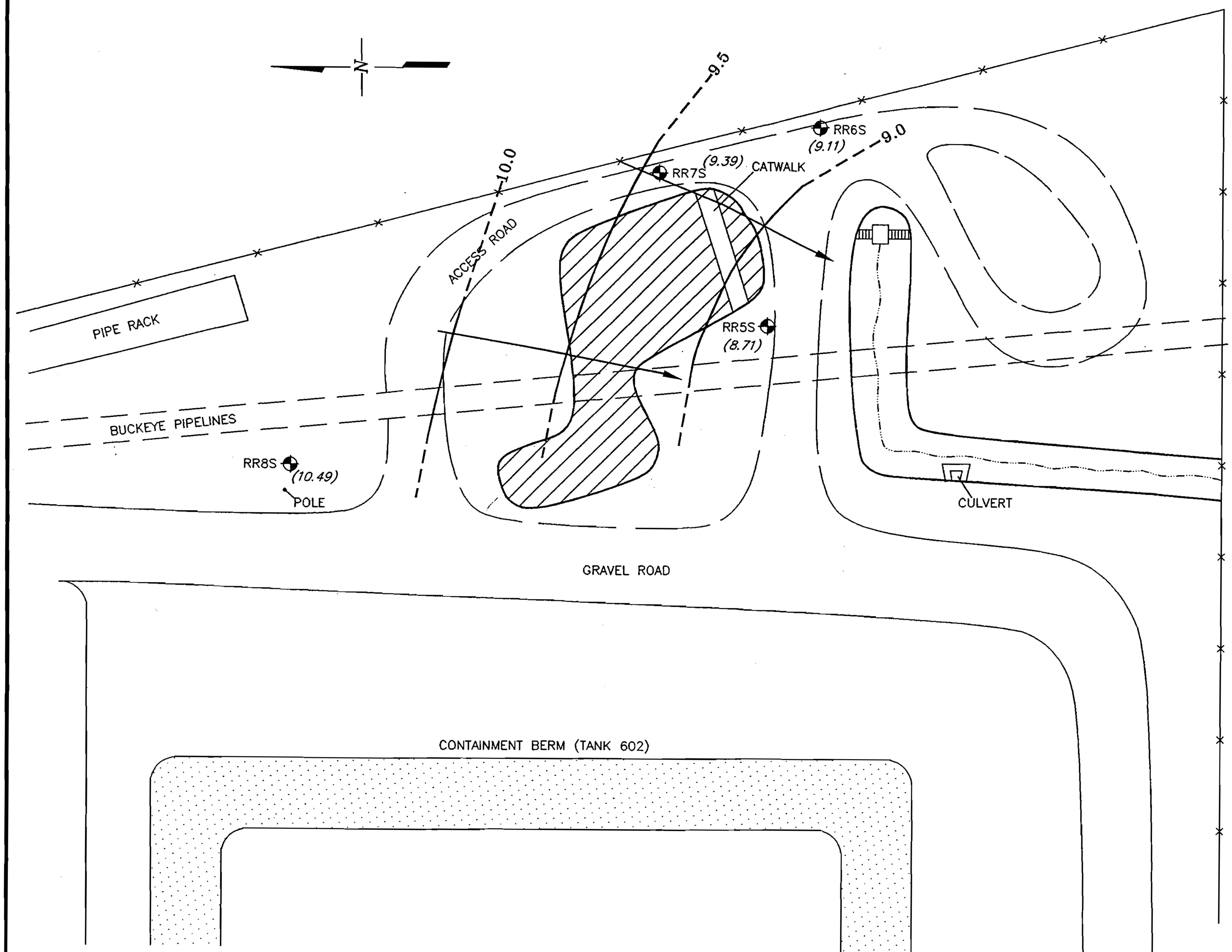
FIGURE: 6

DRAWING NO: 1011-1H

RAHWAY RIVER (WEST)
BAYWAY REFINING COMPANY
LINDEN, NEW JERSEY

DRAWN BY: S.M./N.B.G.

APPR. BY: S.T.S.



KEY

DRAINAGE DITCH

FENCE

EXISTING SEPARATOR

RR8S MONITORING WELL

(8.50) GROUNDWATER ELEVATION IN FEET ABOVE MEAN SEA LEVEL

9.0 GROUNDWATER ELEVATION CONTOUR IN FEET ABOVE MEAN SEA LEVEL (DASHED WHERE INFERRED)

GROUNDWATER FLOW DIRECTION

0 20 40 60 80

Scale in Feet

CONTOUR INTERVAL: 0.5 FEET

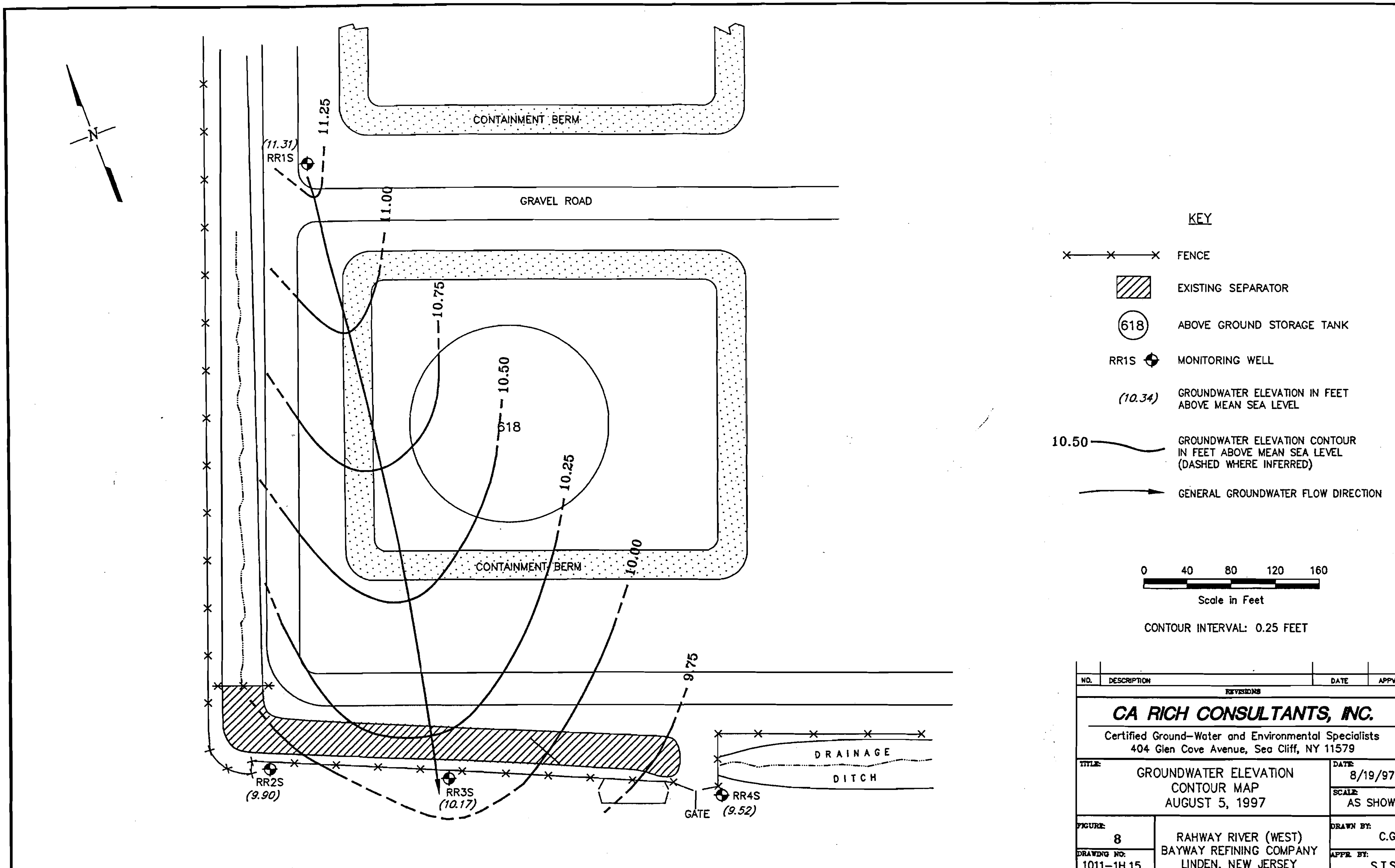
NO.	DESCRIPTION	DATE	APPV.

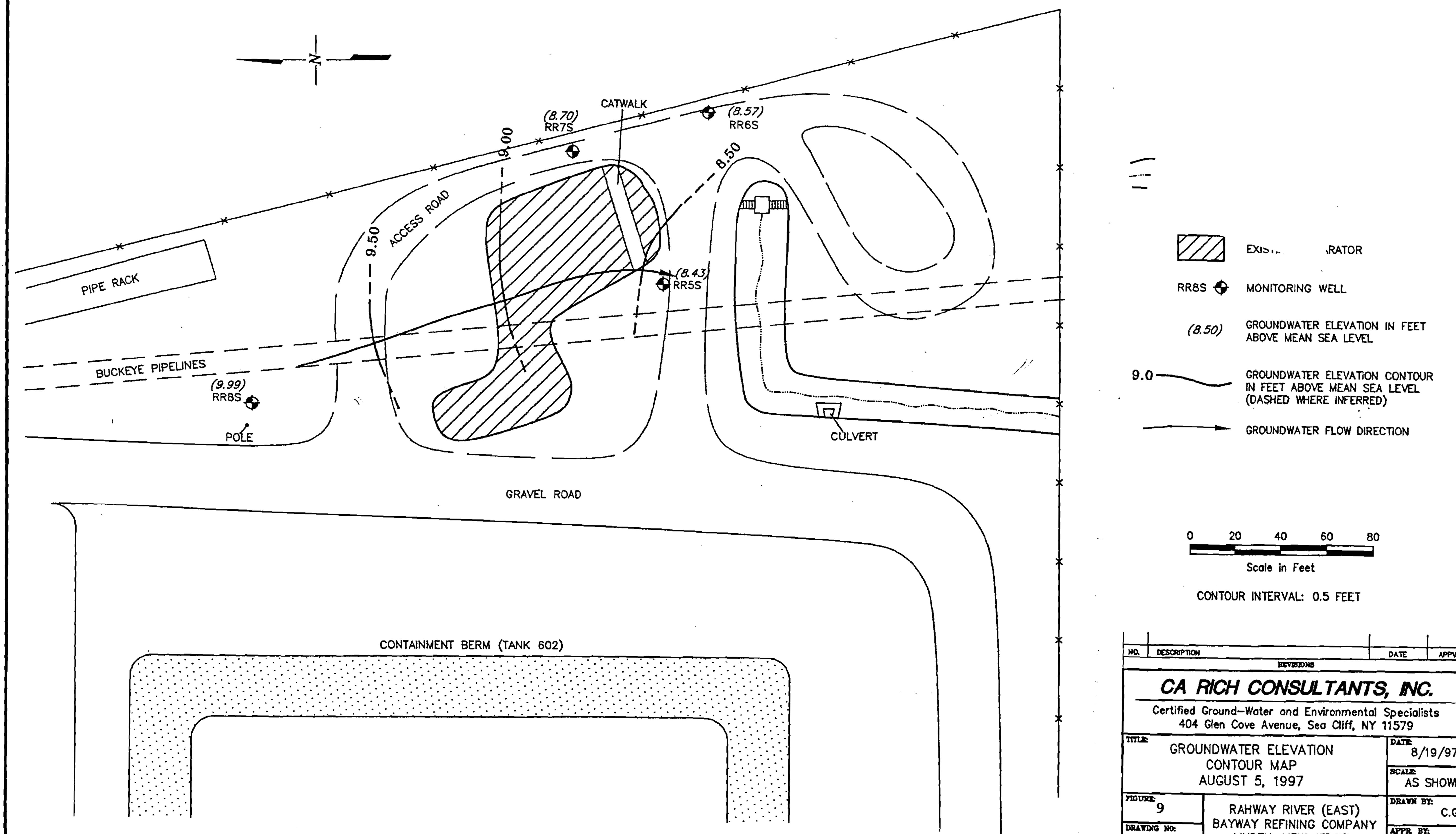
REVISIONS

CA RICH CONSULTANTS, INC.

Certified Ground-Water and Environmental Specialists
404 Glen Cove Avenue, Sea Cliff, NY 11579

TITLE: GROUNDWATER ELEVATION CONTOUR MAP MAY 6, 1997		DATE: 5/22/97 SCALE: AS SHOWN
FIGURE: 7 DRAWING NO: 1011-1g	RAHWAY RIVER (EAST) BAYWAY REFINING COMPANY LINDEN, NEW JERSEY	DRAWN BY: S.M./N.B.G. APPR. BY: S.T.S.


N
CONTAINMENT BERM
11.25
(11.31)
RR1S
GRAVEL ROAD
11.00
10.75
10.50
618
10.25
10.00
CONTAINMENT BERM
9.75
DRAINAGE
DITCH
RR2S
(9.90)
RR3S
(10.17)
GATE
RR4S
(9.52)
KEY
FENCE
EXISTING SEPARATOR
ABOVE GROUND STORAGE TANK
RR1S
MONITORING WELL
(10.34)
GROUNDWATER ELEVATION IN FEET ABOVE MEAN SEA LEVEL
10.50
GROUNDWATER ELEVATION CONTOUR IN FEET ABOVE MEAN SEA LEVEL (DASHED WHERE INFERRED)
GENERAL GROUNDWATER FLOW DIRECTION
0 40 80 120 160
Scale in Feet
CONTOUR INTERVAL: 0.25 FEET
NO. DESCRIPTION DATE APPV.
REVISIONS
CA RICH CONSULTANTS, INC.
Certified Ground-Water and Environmental Specialists
404 Glen Cove Avenue, Sea Cliff, NY 11579
TITLE: GROUNDWATER ELEVATION CONTOUR MAP AUGUST 5, 1997
DATE: 8/19/97
SCALE: AS SHOWN
FIGURE: 8
DRAWING NO: 1011-1H.15
RAHWAY RIVER (WEST)
BAYWAY REFINING COMPANY
LINDEN, NEW JERSEY
DRAWN BY: C.G.
APPR. BY: S.T.S.



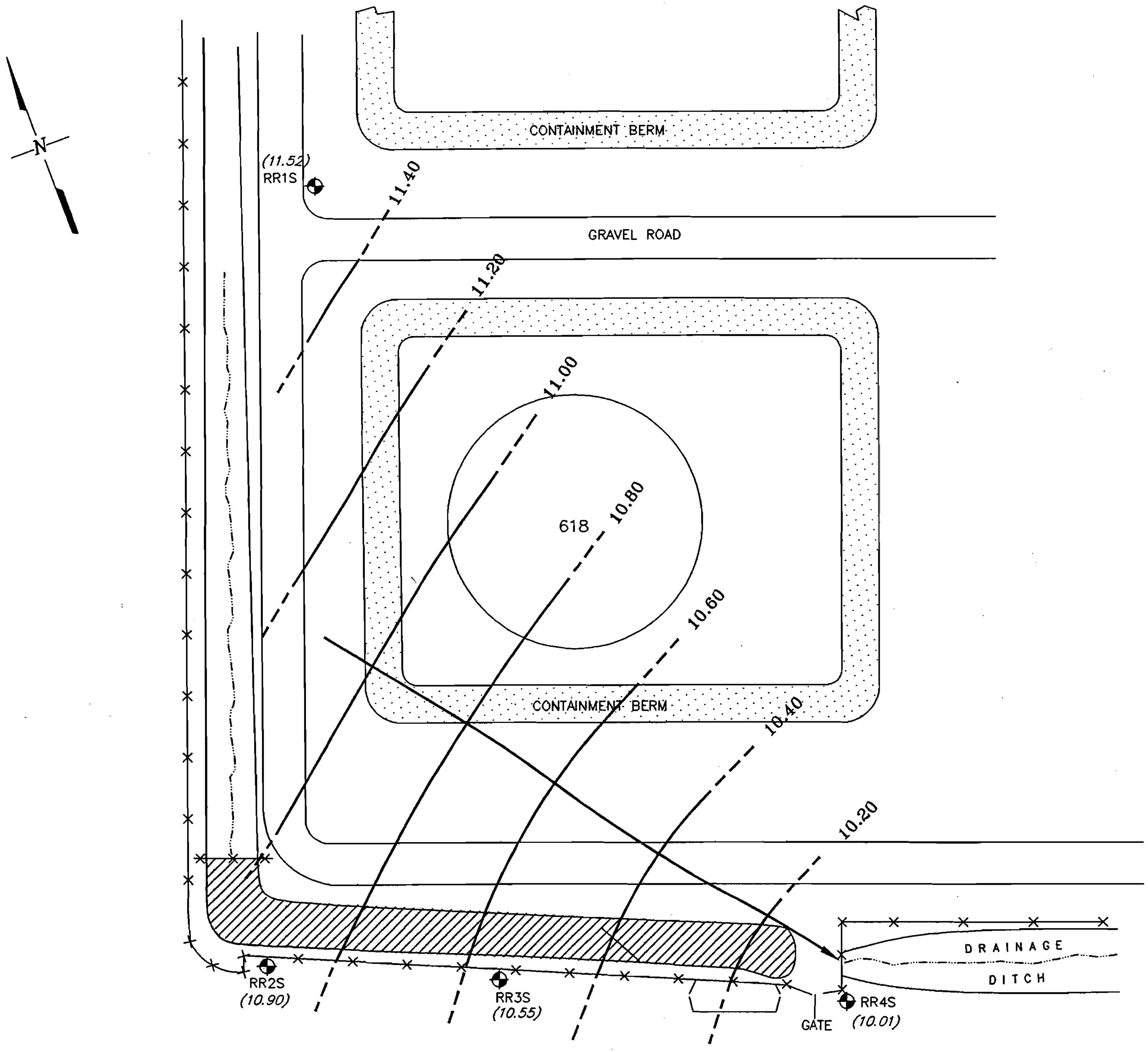
NO.	DESCRIPTION	DATE	APPV.

REVISIONS

CA RICH CONSULTANTS, INC.

Certified Ground-Water and Environmental Specialists
404 Glen Cove Avenue, Sea Cliff, NY 11579

TITLE: GROUNDWATER ELEVATION CONTOUR MAP AUGUST 5, 1997		DATE: 8/19/97
		SCALE: AS SHOWN
FIGURE: 9	RAHWAY RIVER (EAST) BAYWAY REFINING COMPANY LINDEN, NEW JERSEY	DRAWN BY: C.G.
DRAWING NO: 1011-1G.15		APPR. BY: S.T.S.



KEY

FENCE

EXISTING SEPARATOR

618 ABOVE GROUND STORAGE TANK

RR1S MONITORING WELL

(10.52) GROUNDWATER ELEVATION IN FEET ABOVE MEAN SEA LEVEL

10.20 GROUNDWATER ELEVATION CONTOUR IN FEET ABOVE MEAN SEA LEVEL (DASHED WHERE INFERRED)

GENERAL GROUNDWATER FLOW DIRECTION

0 40 80 120 160

Scale in Feet

CONTOUR INTERVAL: 0.20 FEET

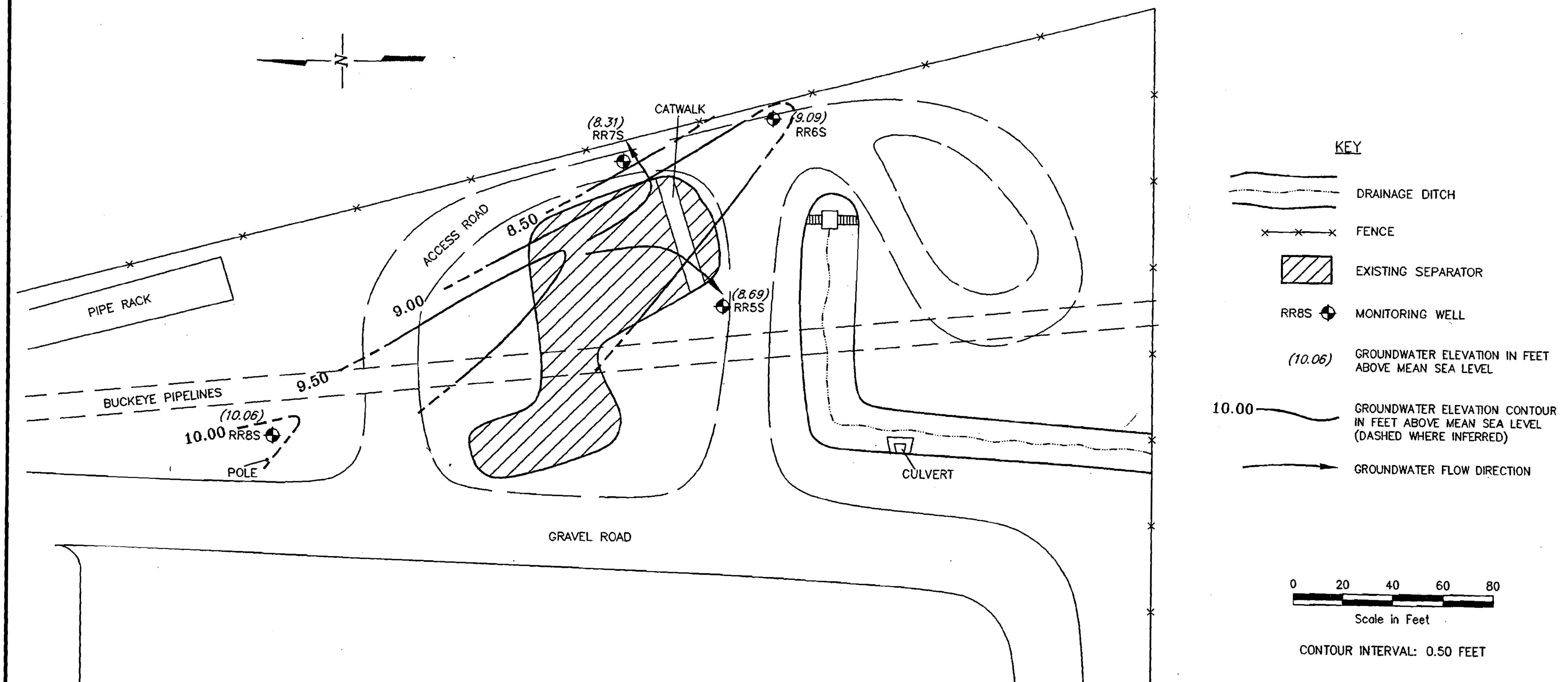
NO.	DESCRIPTION	DATE	APPV.

REVISIONS

CA RICH CONSULTANTS, INC.

Certified Ground-Water and Environmental Specialists
404 Glen Cove Avenue, Sea Cliff, NY 11579

TITLE: GROUNDWATER ELEVATION CONTOUR MAP NOVEMBER 4, 1997		DATE: 11/20/97
		SCALE: AS SHOWN
FIGURE: 10	RAHWAY RIVER (WEST) BAYWAY REFINING COMPANY LINDEN, NEW JERSEY	DRAWN BY: C.G.
DRAWING NO: 1011-1H		APPR. BY: S.T.S.



NO.	DESCRIPTION	DATE	APPV.

REVISIONS

CA RICH CONSULTANTS, INC.

Certified Ground-Water and Environmental Specialists
404 Glen Cove Avenue, Sea Cliff, NY 11579

TITLE: GROUNDWATER ELEVATION CONTOUR MAP NOVEMBER 4, 1997

DATE: 11/20/97

SCALE: AS SHOWN

FIGURE: 11

DRAWING NO: 1011-1G

RAHWAY RIVER (EAST)
BAYWAY REFINING COMPANY
LINDEN, NEW JERSEY

DRAWN BY: C.G.

APPR. BY: S.T.S.

TABLES

Table 1

Summary of Well-Construction Details
Rahway River Tankfield
Bayway Refining Company, Linden, New Jersey

Owner No.	Well Permit No.	Date Built	Well Diameter (inches)	Well Depth (feet)	Screen Interval (ft.BLS)	Elevation Casing (ft.MSL)	Elevation Ground (feet)
RR1S	26-23718-1	2/26/91	4	11.50	1.5 - 11.5	16.10	14.42
RR2S	26-23712-1	2/27/91	4	13.00	3 - 13	16.71	15.23
RR3S	26-23713-0	3/1/91	4	13.00	3 - 13	17.70	15.89
RR4S	26-23714-8	3/4/91	4	13.00	3 - 13	15.29	13.79
RR5S	26-23715-6	5/23/91	4	11.50	3 - 11.5	16.01	14.49
RR6S	26-23716-4	5/29/91	4	13.00	3 - 13	15.40	13.37
RR7S	26-23719-9	5/28/91	4	13.00	3 - 13	14.67	15.09
RR8S	26-23717-2	2/28/91	4	12.00	3 - 11.5	16.23	14.73

Adapted from DRAI, 1993

TABLE 2
SUMMARY OF WATER LEVEL ELEVATIONS
RAHWAY RIVER TANKFIELD SEPARATORS
BAYWAY REFINING COMPANY, LINDEN, NEW JERSEY

Well Number	Top of Inner Casing Elevation Above MSL (Feet)	Screened Interval Elevation (MSL)	Elevation of Water Surface Above Mean Sea Level											
			Jul-91	Dec-91	Feb-92	May-92	Aug-92	Nov-92	Feb-93	May-93	Aug-93	Nov-93	Feb-94	May-94
RR1S	16.10	14 - 4	11.35	11.79	11.27	11.68	11.01	11.16	11.59	11.58	9.43	11.39	11.78	11.32
RR2S	16.71	12 - 2	9.80	10.81	10.46	10.53	9.89	10.13	10.30	10.15	9.18	10.64	10.53	10.67
RR3S	17.70	13 - 3	9.98	10.73	10.39	10.91	9.89	10.20	10.50	10.55	8.99	10.59	10.90	10.78
RR4S	15.29	11 - 1	8.98	10.14	10.14	10.39	9.11	9.57	10.16	10.08	8.04	9.70	10.47	10.30
RR5S	16.01	11 - 3	8.10	8.39	7.82	8.49	8.03	8.16	8.01	8.30	7.37	8.18	8.33	6.13
RR6S	15.40	10 - 0	8.53	9.90	8.27	9.62	8.02	9.04	8.76	8.85	7.03	9.43	9.48	8.54
RR7S	14.67	12 - 2	8.99	9.69	8.75	9.51	8.82	9.10	9.25	8.87	8.01	9.91	9.77	9.08
RR8S	16.23	11 - 3	10.60	10.82	9.80	10.84	10.17	10.20	10.38	10.59	9.57	10.62	10.59	10.25

TABLE 2 (continued)
SUMMARY OF WATER LEVEL ELEVATIONS
RAHWAY RIVER TANKFIELD SEPARATORS
BAYWAY REFINING COMPANY, LINDEN, NEW JERSEY

Well Number	Top of Inner Casing Elevation Above MSL (Feet)	Screened Interval Elevation (MSL)	Elevation of Water Surface Above Mean Sea Level											
			Aug-94	Nov-94	Feb-95	May-95	Aug-95	Nov-95	Feb-96	May-96	Aug-96	Nov-96	Feb-97	May-97
RR1S	16.10	14 - 4	11.32	10.39	11.34	11.42	11.90	11.46	11.46	11.85	11.97	11.35	11.82	11.88
RR2S	16.71	12 - 2	10.02	9.60	10.56	10.26	10.12	10.16	10.21	10.54	10.18	10.01	10.23	10.91
RR3S	17.70	13 - 3	10.20	9.38	10.52	10.65	10.51	10.21	10.52	11.60	10.73	10.34	10.64	11.01
RR4S	15.29	11 - 1	9.28	8.91	10.29	10.27	9.68	9.51	10.19	10.51	10.00	9.91	10.32	10.53
RR5S	16.01	11 - 3	8.30	8.02	8.38	8.41	8.66	8.37	8.31	8.63	8.59	8.23	8.50	8.71
RR6S	15.40	10 - 0	9.06	7.74	7.83	9.17	8.95	8.67	8.68	9.44	9.02	8.49	5.98	9.11
RR7S	14.67	12 - 2	9.17	8.32	8.67	9.37	8.99	8.79	8.70	9.34	8.99	8.64	9.1	9.39
RR8S	16.23	11 - 3	10.75	9.87	8.43	9.98	10.43	9.96	9.68	10.32	10.44	9.82	10.23	10.49

TABLE 2 (continued)
SUMMARY OF WATER LEVEL MEASUREMENTS
RAHWAY RIVER TANKFIELD SEPARATORS
BAYWAY REFINING COMPANY, LINDEN, NEW JERSEY

Well Number	Top of Inner Casing Elevation Above MSL (Feet)	Screened Interval Elevation (MSL)	Elevation of Water Surface Above Mean Sea Level	
			Aug-97	Nov-97
RR1S	16.10	14 - 4	11.31	11.52
RR2S	16.71	12 - 2	9.90	10.90
RR3S	17.70	13 - 3	10.17	10.55
RR4S	15.29	11 - 1	9.52	10.01
RR5S	16.01	11 - 3	8.43	8.69
RR6S	15.40	10 - 0	8.57	9.09
RR7S	14.67	12 - 2	8.7	8.31
RR8S	16.23	11 - 3	9.99	10.06

TABLE 3
WELL RR1S
DETECTED COMPOUNDS AND CONSTITUENTS DURING THE REPORTING PERIOD
RAHWAY RIVER TANKFIELD SEPARATORS, BAYWAY REFINING COMPANY
FEBRUARY, 1997 - NOVEMBER, 1997

	Feb-97	May-97	Aug-97	Nov-97
Volatile Organic Compounds				
benzene	1.0 UA	2.7 A	2.0 G	1.0 UA
methylene chloride	6.0 BA	1.5 UA	1.0 UA	3.0 BA
trichlorofluoromethane	0.7 UA	2.9 UA	0.7 UA	0.7 UA
acetone	5.0 UA	5.0 UA	5.0 UA	5.0 UA
Inorganic Constituents				
Arsenic (total)	10 UA	49.5 A	5 UA	10 UA
Barium (total)	500 UA	325 G	500 UA	500 UA
Barium (dissolved)	500 UA	152 G	500 UA	500 UA
Cadmium (total)	10 UA	10 UA	10 UA	10 UA
Cadmium (dissolved)	10 UA	10 UA	10 UA	10 UA
Chromium (total)	50 UA	27.7 G	50 UA	50 UA
Copper (total)	40.5 A	30.8 A	20 UA	22 G
Copper (dissolved)	20 UA	15 UA	20 UA	20 UA
Lead (total)	8 UA	8.05 A	4 A	4 UA
Zinc (total)	76.5 A	67.45 A	27 G	43.5 A
Zinc (dissolved)	20 UA	35 UA	20 UA	20 UA
Chloride (mg/L)	33.35 A	29.2 A	23.2 A	34.5 A
Iron (mg/L) (total)	29.1 A	24.9 A	6.05 A	19.3 A
Iron (mg/L) (dissolved)	0.564 A	0.865 A	0.97 A	1.2 A
Manganese (mg/L) (total)	9.575 A	9.365 A	7.84 A	8.36 A
Manganese (mg/L) (dissolved)	8.455 A	9.425 A	7.015 A	7.89 A
Sodium (mg/L) (total)	41.65 A	41 A	37.7 A	34.1 A
Sodium (mg/L) (dissolved)	36.5 A	37.85 A	34.7 A	33.45 A
Sulfate (mg/L)	40.9 A	37.85 A	39 A	45.15 A
Solids, dissolved (mg/L)	616.5 A	646 A	598 A	590 A
Salinity (ppt)	0.5	0.5	0.5	0.5
Specific Conductance (µmhos/cm)	800	976	1000	950
Dissolved Oxygen (mg/L)	2.40	4.18	1.50	2.20
Phenols	12 A	13 G	13 A	22 A
pH (Standard Units)	6.66	6.58	6.58	6.66
Temperature (°C)	11.0	12.0	18.0	16.0
Base Neutral Compounds				
acenaphthene	5.0 UA	3.5 UA	5.0 UA	5.0 UA
bis (2-ethylhexyl) phthalate	2.0 JG	4.0 UA	1.0 JG	1.5 JA
fluorene (PAH)	5.0 UA	3.5 UA	5.0 UA	5.0 UA
2-methylnapthalene	4.0 UA	3.0 J	4.0 UA	4.0 UA
dibenzofuran	4.0 UA	4.0 UA	4.0 UA	4.0 UA

Notes: * All values are in micrograms per liter (µg/l, or parts per billion) unless noted otherwise.
U - Indicates element was analyzed for but not detected. The number shown is the detection limit.
J - Indicates an estimated value; result is less than the specified detection limit.
A - Indicates value reported is the mean of two or more determinations.
G - Indicates value reported is the maximum of two or more determinations.
B - Compound was detected in the method/extraction blank as well as the sample. The data user is warned of possible lab introduced contamination.
NA - Not Analyzed.

TABLE 4
WELL RR2S
DETECTED COMPOUNDS AND CONSTITUENTS DURING THE REPORTING PERIOD
RAHWAY RIVER TANKFIELD SEPARATORS, BAYWAY REFINING COMPANY
FEBRUARY, 1997 - NOVEMBER, 1997

	Feb-97	May-97	Aug-97	Nov-97
Volatile Organic Compounds				
benzene	1.0 U	1.0 U	1.0 U	1.0 U
methylene chloride	3.0 B	1.0 U	1.0 U	1.0 B
trichlorofluoromethane	0.7 U	0.7 U	0.7 U	0.7 U
acetone	5.0 U	5.0 U	5.0 U	5.0 U
Inorganic Constituents				
Arsenic (total)	10 U	10 U	5 U	10 U
Barium (total)	500 U	500 U	500 U	500 U
Barium (dissolved)	500 U	500 U	500 U	500 U
Cadmium (total)	10 U	10 U	10 U	10 U
Cadmium (dissolved)	10 U	10 U	10 U	10 U
Chromium (total)	50 U	50 U	50 U	50 U
Copper (total)	37	62	20 U	20 U
Copper (dissolved)	20 U	20 U	20 U	20 U
Lead (total)	8 U	56	5	4 U
Zinc (total)	47	180	30	20 U
Zinc (dissolved)	33	41	20 U	20 U
Chloride (mg/L)	153	57.4	78	36.3
Iron (mg/L) (total)	10.9	24.7	1.2	4.12
Iron (mg/L) (dissolved)	1.19	0.303	0.2	0.1 U
Manganese (mg/L) (total)	5.94	1.01	0.523	0.171
Manganese (mg/L) (dissolved)	4.68	0.537	0.387	0.08
Sodium (mg/L) (total)	88	48.7	48	40
Sodium (mg/L) (dissolved)	85	47.9	42.7	40
Sulfate (mg/L)	275	449	270	232
Solids, dissolved (mg/L)	878	938	728	532
Salinity (ppt)	1.0	1.0	0.5	0.5
Specific Conductance (µmhos/cm)	1250	1100	900	861
Dissolved Oxygen (mg/L)	2.56	4.02	1.98	5.45
Phenols	13	9 U	9 U	12
pH (Standard Units)	6.51	6.77	6.24	6.54
Temperature (°C)	11.0	12.0	16.0	15.0
Base Neutral Compounds				
acenaphthene	5.0 U	5.0 U	5.0 U	5.0 U
bis (2-ethylhexyl) phthalate	3.0 U	1.0 J	3.0 U	3.0 U
fluorene (PAH)	5.0 U	5.0 U	5.0 U	5.0 U
2-methylnapthalene	4.0 U	4.0 U	4.0 U	4.0 U
dibenzofuran	4.0 U	4.0 U	4.0 U	4.0 U

Notes: * All values are in micrograms per liter (µg/l, or parts per billion) unless noted otherwise.
U - Indicates element was analyzed for but not detected. The number shown is the detection limit.
J - Indicates an estimated value; result is less than the specified detection limit.
A - Indicates value reported is the mean of two or more determinations.
G - Indicates value reported is the maximum of two or more determinations.
B - Compound was detected in the method/extraction blank as well as the sample. The data user is warned of possible lab introduced contamination.
NA - Not Analyzed.

TABLE 5
WELL RR3S
DETECTED COMPOUNDS AND CONSTITUENTS DURING THE REPORTING PERIOD
RAHWAY RIVER TANKFIELD SEPARATORS, BAYWAY REFINING COMPANY
FEBRUARY, 1997 - NOVEMBER, 1997

	Feb-97	May-97	Aug-97	Nov-97
Volatile Organic Compounds				
benzene	1.0 U	1.0 U	1.0 U	1.0 U
methylene chloride	2.0 B	1.0 U	2.0	1.0 B
trichlorofluoromethane	0.7 U	0.7 U	2.0	0.7 U
acetone	8.0	5.0 U	18.0	5.0 U
Inorganic Constituents				
Arsenic (total)	10 U	20	20	12
Barium (total)	500 U	500 U	500 U	500 U
Barium (dissolved)	500 U	500 U	500 U	500 U
Cadmium (total)	10 U	10 U	10 U	10 U
Cadmium (dissolved)	10 U	10 U	10 U	10 U
Chromium (total)	50 U	50 U	50 U	50 U
Copper (total)	45	74	33	24
Copper (dissolved)	20 U	21	20 U	20 U
Lead (total)	8 U	16	2 U	4 U
Zinc (total)	37	61	31	72
Zinc (dissolved)	20 U	39	31	20 U
Chloride (mg/L)	318	123	240	66.9
Iron (mg/L) (total)	9.57	25.4	7	19.3
Iron (mg/L) (dissolved)	1.33	0.192	3	0.1 U
Manganese (mg/L) (total)	3.15	0.622	3.15	1.68
Manganese (mg/L) (dissolved)	3.14	0.31	2.74	0.697
Sodium (mg/L) (total)	108	71.4	143	59.5
Sodium (mg/L) (dissolved)	105	68.5	142	58.2
Sulfate (mg/L)	101	120	815	64.2
Solids, dissolved (mg/L)	1010	697	2190	546
Salinity (ppt)	1.0	1.0	1.0	1.0
Specific Conductance (µmhos/cm)	1000	900	2480	1350
Dissolved Oxygen (mg/L)	2.50	4.19	3.88	2.59
Phenols	9 U	17	17	14
pH (Standard Units)	6.79	6.59	6.47	6.51
Temperature (°C)	12.0	11.0	17.0	16.0
Base Neutral Compounds				
acenaphthene	5.0 U	5.0 U	5.0 U	5.0 U
bis (2-ethylhexyl) phthalate	2.0 J	1.0 J	1.0 J	3.0 U
fluorene (PAH)	5.0 U	5.0 U	5.0 U	5.0 U
2-methylnapthalene	4.0 U	4.0 U	4.0 U	5.0 U
dibenzofuran	4.0 U	4.0 U	4.0 U	5.0 U

Notes: * All values are in micrograms per liter (µg/l, or parts per billion) unless noted otherwise.
U - Indicates element was analyzed for but not detected. The number shown is the detection limit.
J - Indicates an estimated value; result is less than the specified detection limit.
A - Indicates value reported is the mean of two or more determinations.
G - Indicates value reported is the maximum of two or more determinations.
B - Compound was detected in the method/extraction blank as well as the sample. The data user is warned of possible lab introduced contamination.
NA - Not Analyzed.

TABLE 6
WELL RR4S
DETECTED COMPOUNDS AND CONSTITUENTS DURING THE REPORTING PERIOD
RAHWAY RIVER TANKFIELD SEPARATORS, BAYWAY REFINING COMPANY
FEBRUARY, 1997 - NOVEMBER, 1997

	Feb-97	May-97	Aug-97	Nov-97
Volatile Organic Compounds				
benzene	1.0 U	1.0 U	1.0 U	1.0 U
methylene chloride	4.0 B	1.0 U	1.0 U	3.0 B
trichlorofluoromethane	0.7 U	0.7 U	0.7 U	0.7 U
acetone	5.0 U	5.0 U	5.0 U	15.0
Inorganic Constituents				
Arsenic (total)	10 U	10 U	5 U	12
Barium (total)	500 U	500 U	500 U	500 U
Barium (dissolved)	500 U	500 U	500 U	500 U
Cadmium (total)	10 U	10 U	10 U	10 U
Cadmium (dissolved)	10 U	10 U	10 U	10 U
Chromium (total)	50 U	50 U	50 U	50 U
Copper (total)	37	36	20 U	151
Copper (dissolved)	23	22	20 U	20 U
Lead (total)	8 U	5 U	2 U	4 U
Zinc (total)	42	63	20 U	123
Zinc (dissolved)	20 U	41	20 U	43
Chloride (mg/L)	339	551	120	105
Iron (mg/L) (total)	10.1	13.3	1.25	33.1
Iron (mg/L) (dissolved)	0.1 U	0.148	0.1 U	2.74
Manganese (mg/L) (total)	0.883	3.99	1.19	2.17
Manganese (mg/L) (dissolved)	0.295	3.82	0.874	1.79
Sodium (mg/L) (total)	120	336	128	81.7
Sodium (mg/L) (dissolved)	120	336	113	81.4
Sulfate (mg/L)	173	273	87	462
Solids, dissolved (mg/L)	1250	1650	636	1120
Salinity (ppt)	2.0	1.0	1.0	1.0
Specific Conductance (µmhos/cm)	2300	1300	1210	1181
Dissolved Oxygen (mg/L)	2.31	2.80	2.57	3.00
Phenols	9 U	9 U	14	17
pH (Standard Units)	6.69	6.60	6.71	6.43
Temperature (°C)	12.0	12.0	16.0	15.0
Base Neutral Compounds				
acenaphthene	5.0 U	5.0 U	5.0 U	5.0 U
bis (2-ethylhexyl) phthalate	3.0 U	1.0 J	3.0 U	3.0 U
fluorene (PAH)	5.0 U	5.0 U	5.0 U	5.0 U
2-methylnapthalene	4.0 U	4.0 U	4.0 U	4.0 U
dibenzofuran	4.0 U	4.0 U	4.0 U	4.0 U

Notes: * All values are in micrograms per liter (µg/l, or parts per billion) unless noted otherwise.
U - Indicates element was analyzed for but not detected. The number shown is the detection limit.
J - Indicates an estimated value; result is less than the specified detection limit.
A - Indicates value reported is the mean of two or more determinations.
G - Indicates value reported is the maximum of two or more determinations.
B - Compound was detected in the method/extraction blank as well as the sample. The data user is warned of possible lab introduced contamination.
NA - Not Analyzed.

TABLE 7
WELL RR5S
DETECTED COMPOUNDS AND CONSTITUENTS DURING THE REPORTING PERIOD
RAHWAY RIVER TANKFIELD SEPARATORS, BAYWAY REFINING COMPANY
FEBRUARY, 1997 - NOVEMBER, 1997

	Feb-97	May-97	Aug-97	Nov-97
Volatile Organic Compounds				
benzene	1.0 U	1.0 U	1.0 U	1.0 U
methylene chloride	2.0 JB	1.0 U	1.0 U	1.0 U
trichlorofluoromethane	0.7 U	0.7 U	0.7 U	0.7 U
acetone	5.0 U	5.0 U	5.0 U	5.0 U
Inorganic Constituents				
Arsenic (total)	10 U	36	5 U	5 U
Barium (total)	500 U	500 U	500 U	500 U
Barium (dissolved)	500 U	500 U	500 U	500 U
Cadmium (total)	10 U	10 U	10 U	10 U
Cadmium (dissolved)	10 U	10 U	10 U	10 U
Chromium (total)	50 U	50 U	50 U	50 U
Copper (total)	32	20 U	20 U	20 U
Copper (dissolved)	20 U	20 U	20 U	20 U
Lead (total)	8 U	5 U	2 U	4 U
Zinc (total)	21	20 U	20 U	20 U
Zinc (dissolved)	20 U	20 U	20 U	37
Chloride (mg/L)	6.98	7.61	7.2	7.13
Iron (mg/L) (total)	9.23	2.81	0.515	0.26
Iron (mg/L) (dissolved)	0.1 U	0.1 U	0.1 U	0.1 U
Manganese (mg/L) (total)	2.01	0.957	2.91	2.85
Manganese (mg/L) (dissolved)	1.37	0.619	2.21	2.85
Sodium (mg/L) (total)	21.6	25.3	26	23.2
Sodium (mg/L) (dissolved)	21.6	25.2	23	22.7
Sulfate (mg/L)	46.3	48	44.3	42.2
Solids, dissolved (mg/L)	319	332	340	344
Salinity (ppt)	0.0	0.0	0.0	0.3
Specific Conductance (µmhos/cm)	250	405	610	605
Dissolved Oxygen (mg/L)	2.51	4.38	4.10	4.10
Phenols	9 U	9 U	9 U	9 U
pH (Standard Units)	6.10	5.90	6.00	6.09
Temperature (°C)	11.0	11.0	17.0	17.0
Base Neutral Compounds				
acenaphthene	5.0 U	5.0 U	5.0 U	5.0 U
bis (2-ethylhexyl) phthalate	3.0 U	1.0 J	3.0 U	3.0 U
fluorene (PAH)	5.0 U	5.0 U	5.0 U	5.0 U
2-methylnapthalene	4.0 U	4.0 U	4.0 U	4.0 U
dibenzofuran	4.0 U	4.0 U	4.0 U	4.0 U

Notes: * All values are in micrograms per liter (µg/l, or parts per billion) unless noted otherwise.
U - Indicates element was analyzed for but not detected. The number shown is the detection limit.
J - Indicates an estimated value; result is less than the specified detection limit.
A - Indicates value reported is the mean of two or more determinations.
G - Indicates value reported is the maximum of two or more determinations.
B - Compound was detected in the method/extraction blank as well as the sample. The data user is warned of possible lab introduced contamination.
NA - Not Analyzed.

TABLE 8
WELL RR6S
DETECTED COMPOUNDS AND CONSTITUENTS DURING THE REPORTING PERIOD
RAHWAY RIVER TANKFIELD SEPARATORS, BAYWAY REFINING COMPANY
FEBRUARY, 1997 - NOVEMBER, 1997

	Feb-97	May-97	Aug-97	Nov-97
Volatile Organic Compounds				
benzene	1.0 U	1.0 U	1.0 U	1.0 U
methylene chloride	2.0 JB	3.0	1.0	1.0 U
trichlorofluoromethane	0.7 U	0.7 U	1.0	1.0 U
acetone	5.0 U	5.0 U	5.0 U	5.0 U
Inorganic Constituents				
Arsenic (total)	5 U	10 U	5 U	5 U
Barium (total)	500 U	500 U	500 U	500 U
Barium (dissolved)	500 U	500 U	500 U	500 U
Cadmium (total)	10 U	10 U	10 U	10 U
Cadmium (dissolved)	10 U	10 U	10 U	10 U
Chromium (total)	50 U	50 U	50 U	50 U
Copper (total)	20 U	20 U	20 U	20 U
Copper (dissolved)	20 U	20 U	20 U	20 U
Lead (total)	8 U	5 U	2 U	4 U
Zinc (total)	20 U	20 U	20 U	42
Zinc (dissolved)	20 U	20 U	20 U	20 U
Chloride (mg/L)	9.08	9.45	10	10.6
Iron (mg/L) (total)	3.4	1.83	0.66	11.5
Iron (mg/L) (dissolved)	0.1 U	0.1 U	0.1 U	0.1 U
Manganese (mg/L) (total)	0.11	0.058	0.025	0.581
Manganese (mg/L) (dissolved)	0.02 U	0.02 U	0.02 U	0.02 U
Sodium (mg/L) (total)	9.7	10.1	9	8.9
Sodium (mg/L) (dissolved)	9	8.3	8.5	8.1
Sulfate (mg/L)	36.8	39.7	34.5	39.7
Solids, dissolved (mg/L)	144	165	150	178
Salinity (ppt)	0.0	0.0	0.0	0.0
Specific Conductance (µmhos/cm)	150	419	470	230
Dissolved Oxygen (mg/L)	2.47	3.21	3.74	3.30
Phenols	24	9 U	11	9 U
pH (Standard Units)	6.02	5.81	5.47	5.60
Temperature (°C)	12.0	12.0	18.0	17.0
Base Neutral Compounds				
acenaphthene	5.0 U	5.0 U	5.0 U	5.0 U
bis (2-ethylhexyl) phthalate	3.0 U	3.0 U	3.0 U	3.0 U
fluorene (PAH)	5.0 U	5.0 U	5.0 U	5.0 U
2-methylnapthalene	4.0 U	4.0 U	4.0 U	5.0 U
dibenzofuran	4.0 U	4.0 U	4.0 U	5.0 U

Notes: * All values are in micrograms per liter (µg/l, or parts per billion) unless noted otherwise.
U - Indicates element was analyzed for but not detected. The number shown is the detection limit.
J - Indicates an estimated value; result is less than the specified detection limit.
A - Indicates value reported is the mean of two or more determinations.
G - Indicates value reported is the maximum of two or more determinations.
B - Compound was detected in the method/extraction blank as well as the sample. The data user is warned of possible lab introduced contamination.
NA - Not Analyzed.

TABLE 9
WELL RR7S
DETECTED COMPOUNDS AND CONSTITUENTS DURING THE REPORTING PERIOD
RAHWAY RIVER TANKFIELD SEPARATORS, BAYWAY REFINING COMPANY
FEBRUARY, 1997 - NOVEMBER, 1997

	Feb-97	May-97	Aug-97	Nov-97
Volatile Organic Compounds				
benzene	1.0 U	1.0 U	1.0 U	1.0 U
methylene chloride	3.0 B	1.0 U	1.0 U	1.0 U
trichlorofluoromethane	0.7 U	0.7 U	0.7 U	0.7 U
acetone	5.0 U	5.0 U	5.0 U	5.0 U
Inorganic Constituents				
Arsenic (total)	5 U	10 U	5 U	5 U
Barium (total)	500 U	500 U	500 U	500 U
Barium (dissolved)	500 U	500 U	500 U	500 U
Cadmium (total)	16	10 U	12	16
Cadmium (dissolved)	10 U	10 U	10 U	11
Chromium (total)	50 U	50 U	50 U	50 U
Copper (total)	78	24	20 U	20 U
Copper (dissolved)	20 U	20 U	20 U	20 U
Lead (total)	15	5 U	2 U	4 U
Zinc (total)	124	90	85	157
Zinc (dissolved)	33	90	77	157
Chloride (mg/L)	11.8	10	12.6	15.5
Iron (mg/L) (total)	19.8	7.2	1.9	3.68
Iron (mg/L) (dissolved)	0.1 U	0.1 U	0.1 U	0.1 U
Manganese (mg/L) (total)	0.512	0.117	0.043	0.102
Manganese (mg/L) (dissolved)	0.037	0.02 U	0.02 U	0.049
Sodium (mg/L) (total)	9	8.9	11.4	8.9
Sodium (mg/L) (dissolved)	7.7	8.1	10	8.6
Sulfate (mg/L)	26.6	28.7	28.6	30.3
Solids, dissolved (mg/L)	128	144	156	132
Salinity (ppt)	0.0	0.0	0.0	0.0
Specific Conductance (µmhos/cm)	130	179	230	200
Dissolved Oxygen (mg/L)	2.40	4.36	4.20	3.00
Phenols	9 U	9 U	11	15
pH (Standard Units)	6.11	5.37	5.82	5.76
Temperature (°C)	11.0	12.0	17.0	17.0
Base Neutral Compounds				
acenaphthene	5.0 U	5.0 U	5.0 U	5.0 U
bis (2-ethylhexyl) phthalate	3.0 U	3.0 U	5.0 B	25.0 B
fluorene (PAH)	5.0 U	5.0 U	5.0 U	5.0 U
2-methylnapthalene	4.0 U	4.0 U	4.0 U	5.0 U
dibenzofuran	4.0 U	4.0 U	4.0 U	5.0 U

Notes: * All values are in micrograms per liter (µg/l, or parts per billion) unless noted otherwise.
U - Indicates element was analyzed for but not detected. The number shown is the detection limit.
J - Indicates an estimated value; result is less than the specified detection limit.
A - Indicates value reported is the mean of two or more determinations.
G - Indicates value reported is the maximum of two or more determinations.
B - Compound was detected in the method/extraction blank as well as the sample. The data user is warned of possible lab introduced contamination.
NA - Not Analyzed.

TABLE 10
WELL RR8S
DETECTED COMPOUNDS AND CONSTITUENTS DURING THE REPORTING PERIOD
RAHWAY RIVER TANKFIELD SEPARATORS, BAYWAY REFINING COMPANY
FEBRUARY, 1997 - NOVEMBER, 1997

	Feb-97	May-97	Aug-97	Nov-97
Volatile Organic Compounds				
benzene	1.0	2.0	1.0 U	1.0 U
methylene chloride	3.0 B	1.0	1.0 U	1.0 U
trichlorofluoromethane	0.7 U	0.7 U	0.7 U	0.7 U
acetone	5.0 U	5.0 U	5.0 U	5.0 U
Inorganic Constituents				
Arsenic (total)	5 U	10 U	5 U	5 U
Barium (total)	500 U	500 U	500 U	500 U
Barium (dissolved)	500 U	500 U	500 U	500 U
Cadmium (total)	10 U	10 U	10 U	10 U
Cadmium (dissolved)	10 U	10 U	10 U	10 U
Chromium (total)	50 U	50 U	50 U	50 U
Copper (total)	26	20 U	20 U	20 U
Copper (dissolved)	20 U	20 U	20 U	20 U
Lead (total)	8 U	5 U	2	4 U
Zinc (total)	20 U	20 U	20 U	20 U
Zinc (dissolved)	20 U	20 U	20 U	20 U
Chloride (mg/L)	15.6	14.1	13	13.5
Iron (mg/L) (total)	22.9	32.6	18.7	28.7
Iron (mg/L) (dissolved)	15.2	21.1	17	28.7
Manganese (mg/L) (total)	17.9	17.1	20.1	14.4
Manganese (mg/L) (dissolved)	17.8	17.1	18.3	14.4
Sodium (mg/L) (total)	18.9	22.1	23.4	21.2
Sodium (mg/L) (dissolved)	18.9	22	20	21.2
Sulfate (mg/L)	17.8	25.2	35.4	40.7
Solids, dissolved (mg/L)	343	345	344	300
Salinity (ppt)	0.0	0.0	0.0	0.0
Specific Conductance (µmhos/cm)	320	328	500	480
Dissolved Oxygen (mg/L)	2.60	2.55	2.09	1.80
Phenols	9 U	9 U	11	17
pH (Standard Units)	6.24	6.09	6.52	6.22
Temperature (°C)	12.0	12.0	18.0	16.0
Base Neutral Compounds				
acenaphthene	1.0 J	5.0 U	1.0 J	5.0 U
bis (2-ethylhexyl) phthalate	3.0 U	1.0 J	1.0 JB	6.0 B
fluorene (PAH)	2.0 J	2.0 J	3.0 J	5.0 U
2-methylnapthalene	4.0 U	4.0 U	4.0 U	4.0 U
dibenzofuran	4.0 U	4.0 U	1.0 J	4.0 U

Notes: * All values are in micrograms per liter (µg/l, or parts per billion) unless noted otherwise.
U - Indicates element was analyzed for but not detected. The number shown is the detection limit.
J - Indicates an estimated value; result is less than the specified detection limit.
A - Indicates value reported is the mean of two or more determinations.
G - Indicates value reported is the maximum of two or more determinations.
B - Compound was detected in the method/extraction blank as well as the sample. The data user is warned of possible lab introduced contamination.
NA - Not Analyzed.

TABLE 11
PERCENT CHANGE IN CONCENTRATIONS BASED ON TREND-LINE ANALYSIS
DETECTED COMPOUNDS AND CONSTITUENTS DURING THE REPORTING PERIOD
RAHWAY RIVER, BAYWAY REFINING COMPANY, LINDEN, NJ

Compound or Constituent	Well Number							
	RR1S	RR2S	RR3S	RR4S	RR5S	RR6S	RR7S	RR8S
Arsenic (total)	38.15	-15.06	541.52	40.78	168.33	-39.66	-39.66	-39.66
Barium (total)	-51.29	330.65	-31.37	54.93	1654.06	50.61	82.23	104.76
Barium (dissolved)	13.16	61.54	-52.08	20.83	4290.38	4882.65	3735.22	142.24
Cadmium (total)	159.56	159.56	159.56	159.56	9.20	67.64	-54.18	159.56
Cadmium (dissolved)	99.91	99.91	99.91	99.91	99.91	99.91	330.78	99.31
Chromium (total)	719.09	721.55	97.85	721.55	382.69	721.55	40.73	721.55
Copper (total)	-98.52	13959.86	186.12	861.54	73.92	-55.50	-61.57	285.48
Copper (dissolved)	64.86	113.18	1681.38	353.87	113.18	74.31	66.87	113.18
Lead (total)	-104.09	5260.54	16.33	-64.80	12.23	-89.21	-67.88	-16.73
Zinc (total)	-84.89	1259.69	623.05	1549.79	175.59	-67.82	-36.25	173.68
Zinc (dissolved)	112.05	137.52	98.77	152.33	181.42	90.49	-20.19	110.44
Chloride (mg/L)	41.68	144.30	1641.69	796.53	4.33	102.64	154.86	238.13
Iron (mg/L) (total)	-78.47	-68.15	525.48	224.87	69.65	-84.93	-58.22	1161.35
Iron (mg/L) (dissolved)	-9.24	-81.92	1212.50	-100.83	-55.16	-99.12	174.51	648.69
Manganese (mg/L) (total)	-6.35	-103.00	103.49	82.34	1.67	-80.72	-59.49	50.10
Manganese (mg/L) (dissolved)	-50.00	-74.45	12.38	618.08	92.24	22.98	25.83	72.83
Sodium (mg/L) (total)	-60.60	15.29	223.84	69.73	37.36	18.36	96.55	50.56
Sodium (mg/L) (dissolved)	12.65	88.22	410.67	2958.50	9.87	-2.16	-3.42	28.15
Sulfate (mg/L)	189.31	1142.66	1361.27	2594.28	359.18	75.85	316.03	41.23
Phenols	-54.71	-58.74	-63.87	-54.48	-66.83	-49.14	-53.02	-54.43
Solids, dissolved (mg/L)	-10.64	203.56	173.18	511.80	-12.30	-26.39	-33.70	32.78
Salinity (ppt)	-61.10	-68.18	57.91	231.03	-123.29	-129.44	-131.00	-131.00
Specific Conductance (µmhos/cm)	-12.11	23.66	178.91	196.44	-14.28	67.04	-30.53	-16.90
Dissolved Oxygen (mg/L)	-67.78	-20.35	-14.28	-14.43	-72.43	-63.42	-77.74	-61.69
pH (Standard Units)	-9.07	0.39	-11.59	-8.27	-9.28	-13.38	-19.42	-11.83
Temperature (°C)	-1.50	-15.67	-11.23	-16.66	-14.17	3.73	6.03	-6.87
benzene	-103.72	-69.58	-69.58	-69.58	-69.58	-69.58	-77.51	-55.77

CAROL O'DONNELL KEE
BNPC
JAA

State of New Jersey
Department of Environmental Protection

Christine Todd Whitman
Governor

Robert C. Shinn, Jr.
Commissioner

Bureau of Nonpoint Pollution Control
Division of Water Quality
P. O. Box 029
Trenton, N.J. 08625-0029
Tel: 609-633-7021, 292-0407
FAX: 609-984-2147
www.state.nj.us/dep/dwq/nonpoint.htm

October 1, 1999

CERTIFIED MAIL
RETURN RECEIPT REQUESTED

Mr. George B. Bakun, P.E., Staff Engineer
Tosco Refining LP
1400 Park Avenue
Linden, New Jersey 07036

Re: Tosco Refining LP
Linden, Union County
NJPDES-DGW Permit No. NJ0105104
Effective Date: November 1, 1999

Dear Permittee:

Enclosed is the **FINAL RENEWAL** New Jersey Pollutant Discharge Elimination System Discharge to Ground Water (NJPDES-DGW) Permit to discharge pollutants to the ground waters of the State, issued in accordance with N.J.A.C. 7:14A. Violation of any condition of this permit may subject you to significant penalties.

A copy of the Response to Comments Document, which at a minimum, responds to significant comments as required by N.J.A.C. 7:14A-15.16 is also enclosed.

Within 30 calendar days following your receipt of this permit, under N.J.A.C. 7:14A-17.2 you may submit a request to the Director for an adjudicatory hearing to reconsider or contest the conditions of this permit. Regulations regarding the format and requirements for requesting an adjudicatory hearing may be found in N.J.A.C. 7:14A-17.2 (a) through (f). The request should be made to:

Chief
Bureau of Nonpoint Pollution Control
P.O. Box 029
Trenton, New Jersey 08625-0029

Additionally, your request for an adjudicatory hearing must contain a completed, signed and dated "Administrative Hearing Request Checklist and Tracking Form for Permits" (form attached). The original shall be forwarded to the Office of Legal Affairs and two copies to the Division of Water Quality at the addresses listed on the attached form.

Application for renewal of this permit must be submitted at least 180 days prior to expiration of this permit pursuant to N.J.A.C. 7:14A-2.7(b).

If you have any questions regarding this permit, please contact Mark Miller of my staff at (609) 292-0407.

Sincerely,

Barry Chalofsky

Barry Chalofsky, P.P., Chief
Bureau of Nonpoint Pollution Control

Enclosure

ADJUDICATORY HEARING REQUEST CHECKLIST AND TRACKING FORM
FOR INDIVIDUAL NJPDES PERMITS*

I. Permit Being Appealed:

____
Facility Name

______________________________ ______________________________
Issuance Date of Final Permit Decision | Permit Number

II. Person Requesting Hearing:

______________________________ ______________________________
Name/Organization | Name of Attorney (if applicable)

______________________________ ______________________________
______________________________ ______________________________
______________________________ ______________________________
Address | Address of Attorney

______________________________ ______________________________
Telephone Number | Telephone Number of Attorney

III. Status of Person Requesting Hearing (Check One):

_____ Permittee under the permit number identified above.
Complete A. and C. through I. of Section IV. below.

_____ Person seeking consideration as a party to the action.
Complete B. through I. of Section IV. below.

IV. Include the following information as part of your request:

A. If you are a permittee under the permit number identified above:
1. For the Office of Legal Affairs only, a copy of the permit clearly indicating the permit number and issuance date;
2. A list of the specific contested permit condition(s) and the legal or factual question(s) at issue for each condition, including the basis of any objection;
3. The relevance of the legal and/or factual issues to the permit decision;
4. Suggested revised or alternative permit conditions and how they meet the requirements of the State or Federal Act; and
5. Information supporting the request or other written documents relied upon to support the request, unless this information is already in the administrative record (in which case, such information shall be specifically referenced in the request).

B. If you are a person seeking consideration as a party to the action:
1. A statement setting forth each legal or factual question alleged to be at issue;

*For NJPDES permits, the procedures for requesting an adjudicatory hearing on a final permit decision and for the Department's evaluation and processing of such requests are set forth in N.J.A.C. 7:14A-17.

2. A statement setting forth the relevance of the legal or factual issue to the permit decision, together with a designation of the specific factual areas to be adjudicated;
3. A clear and concise factual statement of the nature and scope of your interest which meets the criteria set forth at N.J.A.C. 7:14A-17.3(c)4;

4. A statement that, upon motion by any party granted by the administrative law judge, or upon order of the administrative law judge's initiative, you shall make yourself, all persons you represent, and all of your officers, directors, employees, consultants, and agents available to appear and testify at the administrative hearing, if granted;
5. Specific references to the contested permit conditions, as well as suggested revised or alternative permit conditions, including permit denials, which, in your judgment, would be required to implement the purposes of the State Act;
6. Identification of the basis for any objection to the application of control or treatment technologies, if identified in the basis or fact sheets, and the alternative technologies or combination of technologies which, in your judgment, are necessary to satisfy the requirements of the State Act;

C. The date you received notification of the final permit decision;
D. The names and addresses of all persons whom you represent;
E. A statement as to whether you raised each legal and factual issue during the public comment period in accordance with N.J.A.C. 7:14A-15.13 (and in accordance with repealed N.J.A.C. 7:14A-8.4, if the public comment period began or ended before May 5, 1997);
F. An estimate of the amount of time required for the hearing;
G. A request, if necessary, for a barrier-free hearing location for disabled persons;
H. A clear indication of any willingness to negotiate a settlement with the Department prior to the Department's processing of your hearing request to the Office of Administrative Law; and
I. This form, completed, signed and dated with all of the information listed above, including attachments, to:
   1. Office of Legal Affairs
      ATTENTION: Adjudicatory Hearing Requests
      Department of Environmental Protection
      401 East State Street
      PO Box 402, Trenton, New Jersey 08625-0402
   2. Barry Chalofsky, P.P., Chief
      Bureau of Nonpoint Pollution Control
      Department of Environmental Protection
      401 East State Street
      P.O. Box 029, Trenton, New Jersey 08625-0029
   3. Any other person named on the permit (if you are a permittee under that permit).
   4. The permittee(s) (if you are a person seeking consideration as a party to the action).

V. Signature: ______________________________ Date: ____________

Working Cost Center 4FDR; Mark Miller, Bureau of Nonpoint Pollution Control

STAY REQUEST FORM

Title and Type of Permit, Issuance Date and Permit Number:

____
____
____
____
____

Name, Address and Telephone Number of Person Requesting a Stay:

____
____
____
____
____

N.J.A.C. 7:14A-17.6 allows requests for stay of any permit condition which the NJDEP has granted a hearing. These regulations also specify the factors which the NJDEP must consider when deciding whether to GRANT or DENY the stay request(s). This completed stay request form, along with all appropriate attachments, shall be submitted to Barry Chalofsky, P.P., Chief, Bureau of Nonpoint Pollution Control, Division of Water Quality, Department of Environmental Protection, P.O. Box 029, Trenton, New Jersey, 08625.

A. List under (A) below the **specific** permit conditions for which you are requesting a stay. Please include page references to the sections of the permit which include the conditions.
B. Indicate under (B) below whether this condition was commented on during the public comment period. [Yes or No]
C. Indicate under (C) below whether an adjudicatory hearing was requested on this condition. [Yes or No]
D. Indicate under (D) below the factor(s) at N.J.A.C. 7:14A-17.6(e)1 which apply. [FACTORS: 1. the pollution source and its impact upon the affected ecosystem(s); 2. the level of pollutant control actually achieved as defined at N.J.A.C. 7:14A-1.2 by the existing treatment facility, 3. the degree and extent that short-term treatment alternatives including their cost may be applied to the existing treatment facility and what treatment level improvements may result from these alternatives; and 4. the cost to achieve total compliance with permit conditions, including the degree and extent of any negative economic impacts on the permittee and the community in relation to the environmental impacts that will result from not achieving compliance with permit conditions.]

	A	B	C	D
•				
•				
•				
•				

(attach additional pages as necessary)

For **EACH** permit condition listed in (A) above, please attach justification for the stay request specific to each of the factors from N.J.A.C. 7:14A-17.6(e)1 listed in (D) above.

Signature: ______________________________ Date: ______________

NEW JERSEY POLLUTANT DISCHARGE ELIMINATION SYSTEM

The New Jersey Department of Environmental Protection hereby grants you a NJPDES permit for the facility/activity named in this document. This permit is the regulatory mechanism used by the department to ensure your discharge will not harm the environment. By complying with the terms and conditions specified, you are assuming an important role in protecting New Jersey's valuable water resources. Your acceptance of this permit is an agreement to conform with all of its provisions when constructing, installing, modifying, or operating any facility for the collection, treatment, or discharge of pollutants to waters of the state. If you have any questions about this document, please feel free to contact the department representative listed in the permit cover letter. Your cooperation in helping us protect and safeguard our state's environment is anticipated and appreciated.

PERMIT NUMBER NJ0105104

Permittee	Co-Permittee
TOSCO REFINING LP 1400 PARK AVENUE LINDEN NJ 07036	

Property Owner	Location of Activity
BAYWAY REFINING CO 1400 PARK AVE LINDEN NJ 07036	BAYWAY REFINING CO 1400 PARK AVE LINDEN NJ 07036

Current Authorization Covered By This Approval And Previous Authorization	Issuance Date	Effective Date	Expiration Date
J :SURFACE IMPOUNDMENT-INDUST	10/01/1999	11/01/1999	10/30/2004

By Authority of:
Commissioner's Office

DEP AUTHORIZATION
Barry Chalofsky, P.P., Chief
Bureau of Nonpoint Pollution Control

(Terms, conditions and provisions attached hereto)

State of New Jersey
Department of Environmental Protection
401 East State Street, P.O. Box 029
Trenton, New Jersey 08625-0029

FACT SHEET
FOR NJPDES PERMIT TO DISCHARGE
INTO THE WATERS OF THE STATE OF NEW JERSEY

NJPDES-DGW PERMIT NUMBER

NJ0105104

NJPDES-DGW DISCHARGE ACTIVITY

J – Surface Impoundment (Industrial)

NAME AND ADDRESS OF PERMITTEE

Tosco Refining LP
1400 Park Avenue
Linden, New Jersey 07036

NAME AND ADDRESS OF FACILITY

Bayway Refining Company
1400 Park Avenue
Linden, New Jersey 07036

RECEIVING WATERS

The discharge to ground water at this facility is to the fill, marsh silt and clay, organic meadow mat and glacial deposits which overlie the Passaic (Brunswick) Formation which is Triassic in age.

GEOGRAPHIC COORDINATES & LOCATION OF THE FACILITY

Latitude: 40° 37' 50" North
Longitude: 74° 12' 20" West

DESCRIPTION OF FACILITY

The Bayway Refinery was constructed in 1908 and has been in operation since 1909 on 1,300 acres in Linden, Union County. The refining process areas consist of process units which use crude petroleum and other petroleum feedstock to manufacture fuel products and petrochemical feedstocks. Crude petroleum is stored in the Tremley Tankfield. From tankage, crude is fed to the pipestill where it is distilled into several major streams. The streams are further refined into a variety of intermediate and finished products by processes such as catalytic cracking, catalytic reforming, alkylation and desulfurization. Final products include LPG, home heating oil, heavy fuel oil, jet fuel, diesel fuel, kerosene, several grades of gasoline and asphalt. Petroleum products are either shipped from the refinery by barge, pipeline, tank car or truck; or they are stored at one of the contiguous tankfield locations.

DESCRIPTION OF DISCHARGE

The discharge to ground water occurs from process wastewater and stormwater surface impoundments and in-ground concrete tanks referred to as: 1) Rahway River Tankfield Separator No. 1 (East Side); 2) Rahway River Tankfield Separator No. 2 (West Side); 3) Forty Acres Tankfield Separator; 4) Tremley Separator; 5) East Side Retention Basin; 6) East Retention Basin; 7) West Separator; 8) Biox Lagoons. This permit does not address historical soil or ground water contamination, which is the responsibility of Exxon Corporation and is managed under an Administrative Consent Order by the Department's Site Remediation Program.

BASIS FOR THE PERMIT CONDITIONS

The discharge described above is a regulated activity under the New Jersey Water Pollution Control Act, N.J.S.A. 58:10A-1 et seq., and its implementing regulations, the New Jersey Pollutant Discharge Elimination System (NJPDES) N.J.A.C. 7:14A-1 et seq. The permit has been developed pursuant to these regulations and is based on the administrative record, which contains any permit application submitted, correspondence concerning the permit, the Fact Sheet and documents cited therein, the results of any past monitoring, the draft permit, and any past permits issued to the facility under these regulations.

The following items were used to formulate the basis of the draft permit:

1	N.J.S.A. 58:10A-1 et seq., New Jersey Water Pollution Control Act.*
2	N.J.A.C. 7:14A, New Jersey Pollutant Discharge Elimination System Regulations.*
3	NJPDES-DGW Permits NJ0087726, NJ0054348, NJ087653 and NJ0105104
4	Ground Water Protection Program Plan approved June 22, 1999
5	Ground Water Monitoring Well Sampling Data submitted under NJPDES Permits NJ0087726, NJ0054348, NJ087653 and NJ0105104
6	DMR Data Submitted Under NJPDES-DGW Permits NJ0087726, NJ0054348, NJ087653 and NJ0105104
7	The NJPDES-DGW Permit Application Submitted
8	Statewide Water Quality Management Planning Rules (N.J.A.C. 7:15)
9	Sludge Quality Assurance Regulations (N.J.A.C. 7:14C)
10	Ground Water Quality Standards (N.J.A.C. 7:9-6)

*The document is part of the administrative record, but is not physically included in the record.

NJDEP CONTACT

Additional information concerning this permit may be obtained during the hours of 8:00 A.M. and 4:30 P.M., Monday through Friday from Mark Miller, Bureau of Nonpoint Pollution Control (609) 292-0407.

<u>RESPONSE TO COMMENTS</u>
For
Tosco Refining LP
NJPDES-DGW Permit NJ0105104

The Draft NJPDES-DGW Permit for Bayway Refining Company was public noticed July 21, 1999 in the <u>DEP Bulletin</u>. During the 30-day public comment period, which began July 21, 1999 and ended on August 21, 1999, the Department received in comments the form of a letter from George B. Bakun, Senior Staff Engineer for the facility, dated August 19, 1999. All comments have been paraphrased and addressed below. The actual comments are also enclosed as a part of the final permit.

Comment 1:

Permit Authorization Sheet

Mr. Bakun indicates that a change in operator is planned for the Bayway Refinery site from the existing Bayway Refining Company to Tosco Refining LP, effective September 1, 1999.

Response: The Department acknowledges the change in operator and the permittee's name will therefore be changed as indicated in your attached August 18, 1999 correspondence.

Comment 2:

Permit Fact Sheet

Mr. Bakun reiterates that a change in operator is planned for the Bayway Refinery site from the existing Bayway Refining Company to Tosco Refining LP, effective September 1, 1999.

Response: The Department acknowledges the change in operator and the permittee's name will therefore be changed as indicated in your attached August 18, 1999 correspondence.

Comments 3 and 4:

Part I: Specific Requirements
Section A: GWPP Discharge and Ground Water Monitoring Requirements
Paragraphs 7, 8 and 9

Mr. Bakun states that, due to the size of the approved GWPP, it is an unnecessary burden to submit the entire GWPP Plan prior to the expiration of the permit and to multiple locations whenever the Department approves an amended GWPP Plan. Rather, the permittee wishes to have the alternative of submitting a letter stating that there are no changes to the GWPP Plan or presenting only those updated sections prior to expiration of the permit. Furthermore, only those sections that have been amended and approved by the Department would be sent to other regulatory agencies.

Response: The Department has revised the permit paragraphs to indicate that if there are no planned changes to the GWPP Plan within 180 days of the permit expiration, a letter may be written to that effect, however, a newly signed and dated certification page must be submitted with that letter. Furthermore, the permit has been modified to allow for sections of the GWPP Plan to be submitted and reviewed by the Department and any amended section would require submission to the applicable agencies, not the entire GWPP Plan.

Comment 5

Part I: Specific Requirements
Section B: GWPP Plan Requirements

Mr. Bakun requests that paragraph 1.E.1 be reworded to be consistent with N.J.A.C. 7:14A-7.6(c.)

Response: The Department has revised the paragraph as requested.

Comment 6

Part I: Specific Requirements
Section B: GWPP Plan Requirements

Mr. Bakun requests that paragraph 1.H be deleted or reworded to indicate that a Maintenance, Inspection and Emergency Operating Manual (or manuals) can be stand alone documents separate from the GWPP plan. This would prevent the potential necessity of submitting all emergency and operating manuals with the submittal of any GWPP plan.

Response: The Department has reworded the paragraph as requested.

Comment 7

Part I: Specific Requirements
Section C: Additional Requirements

Mr. Bakun requests that the Department acknowledge that operation and maintenance manuals have been completed for the regulated units as stated in previously mailed correspondence dated May 12, 1997, which are referenced in paragraph 1 of this section.

Response: The Department acknowledges that the facility has indicated that they have completed operation and maintenance manuals for the regulated units at the facility. The confirmation of the existence of these manuals and their completeness pertaining to the requirements of this permit will be made during the annual inspections conducted by the Bureau of Water Compliance and Enforcement and/or by review by staff of the Bureau of Nonpoint Pollution Control.

Comment 8

Part I: Specific Requirements
Section C: Additional Requirements
Paragraph 1.B.

Mr. Bakun requests that the Department remove the requirement to maintain records of maintenance and inspection of the regulated units. He further states that the maintenance of these records would be unduly burdensome and would result in considerably more time spent documenting activities, leaving far less time to conduct activities.

Response: The Department disagrees that the requirement to maintain records of maintenance and inspection activities associated with the regulated units is unduly burdensome. Routinely, these records consist of a consolidated list of maintenance and inspection activities that site personnel must date and initial to confirm that the activity was completed and should only take a few moments to complete. Only those regular maintenance and inspection activities that are conducted in accordance with NJPDES-DGW requirements need to be documented. However, if the permittee wishes, an alternate method of tracking the required maintenance and inspection activities may be proposed to the Department for approval.

Comment 9

Part I: Specific Requirements
Section C: Additional Requirements
Paragraph 1.E.2.

Mr. Bakun strongly objects to the inclusion of "pollutant generation" units in the requirement of maintenance and inspections of process units. He requests that the reference be changed to include only those units as regulated by N.J.A.C. 7:14A-6.12(c) limiting the requirements for operation and maintenance requirements to treatment works, including related appurtenances and collection system.

Response: The Department has revised this paragraph as requested.

Comment 10

Part I: Specific Requirements
Section D: Monitoring and Reporting Requirements

Mr. Bakun requests that the Department acknowledge that the sampling plan required in paragraph 1.F., to be submitted within 30 days of a written request by the Department, was already submitted to the Department as part of the approved GWPP plan.

Response: The Department acknowledges that the facility has submitted a sampling plan as part of the approved GWPP plan.

Comment 11

Part III: Special Conditions
Section A: Contingency Requirements
E&O Manual

Mr. Bakun requests that the Department modify this paragraph with the wording "as appropriate" since all six requirements will likely not be applicable in every case.

Response: The Department has modified the permit as requested.

Comment 12

Part III: Special Conditions
Section A: Contingency Requirements
Paragraph B.3.

Mr. Bakun requests that the Department delete this paragraph since it appears to exceed current NJPDES requirements. A TWA is specifically required by N.J.A.C. 7:14A-22.3 for "building, installing, modifying or operating" only. Previous references to repairs have been deleted in current regulation.

Response: The Department has modified the permit to reflect that repairs do not require a Treatment Works Approval. However, the paragraph has been rewritten to indicate that the permittee must contact the Bureau of Engineering North to determine if the activity is a "repair" or "modification" in the event there is any question as to the exact nature of the activity.

Comment 13

Part III: Special Conditions
Section A: Contingency Requirements
Paragraph B.4.

Mr. Bakun requests that the Department modify this paragraph with the qualifier "if needed" since there are exceptions to the need for a TWA at N.J.A.C. 7:14A-22.4.

Response: The Department has modified the permit to reflect that a TWA must be obtained only if needed.

Comment 14

Part III: Special Conditions
Section B: Compliance with Other Rules
Paragraph 2

Mr. Bakun requests that the Department modify this paragraph since it appears to exceed current NJPDES requirements. A TWA is specifically required by N.J.A.C. 7:14A-22.3 for "building, installing, modifying or operating" only. Previous references to repairs have been deleted in current regulation and the word repairs should be replaced with "modifications".

Response: The Department has modified the paragraph, changing "major repairs" to "modifications".

Comment 15

Part IV: General Conditions for Individual NJPDES Permits
Section E: Additional Conditions

Mr. Bakun requests that the Department acknowledge that operator names have previously been submitted to the Department, as required, for all of the regulated facilities.

Response: The Department acknowledges that operator names have previously been submitted to the Department as required.

Bayway Refining Company
a subsidiary of To[illegible]rporation
1400 Park A[illegible]
Linden, N[illegible]

AUG 20 1999

CERTIFIED MAIL - RRR
Z 453 166 337

August 19, 1999

Comments on
Draft Renewal Permit
NJPDES-DGW NJ0105104

New Jersey Department of Environmental Protection
Bureau of Nonpoint Pollution Control
Division of Water Quality
P.O. Box 029
Trenton, NJ 08625-0029
Attn.: Mr. Barry Chalofsky

Dear Mr. Chalofsky

Attached are our comments on the Draft Renewal Permit for NJPDES-DGW Permit No. 0105104, permitting discharges to ground water at the Bayway Refinery site in Linden, New Jersey. In general, we are very supportive of the GWPP approach incorporated into the permit. The majority of comments that we have submitted are intended to ensure consistency with NJPDES regulatory requirements and to minimize any permit requirements that may be unnecessarily burdensome.

Please contact me at (908) 523-5896 if there are any questions on our comments.

Very Truly Yours,

George B. Bakun

George B. Bakun
Senior Staff Engineer

c: Mark Miller, NJDEP
John Roe, NJDEP

Comments on Draft Renewal Permit
NJPDES-DGW Permit No. NJ0105104

Permit Authorization Sheet

Comment 1. The permittee and property owner are listed as Bayway Refining Company. As stated in the attached August 18, 1999 letter, a change in operator is planned from Bayway Refining Company to Tosco Refining L P for the Bayway Refinery site, effective September 1, 1999. No other changes are planned. Please revise the name of the permittee accordingly.

Permit Fact Sheet

Comment 2. Name and Address of Permittee: Same as comment 1. Also, consistent with comment 1, please revise the name of the facility from Bayway Refining Company to Bayway Refinery.

Part I: Specific Requirements
Section A: GWPP Discharge and Ground Water Monitoring Requirements

Comment 3. Paragraph 7 requires the submittal of an updated GWPP plan prior to the expiration date of the permit unless an expedited permit renewal is approved. The approved GWPP Plan for the Bayway Refinery site is very large. To avoid having to unnecessarily submit the entire document, we request that the Department also allow the alternative of a letter either stating that there are no proposed changes to the approved GWPP Plan or presenting only the updated sections.

Comment 4. Paragraphs 8 and 9 require sending copies of the GWPP Plan to multiple locations whenever an amended GWPP Plan is approved by the Department. As stated in Comment 3, the approved GWPP Plan for the Bayway Refinery site is very large. To avoid having to submit the entire document to multiple locations, we request that the Department allow the alternative of a letter presenting only the amended sections that were approved.

Section B. GWPP Plan Requirements

Comment 5. Paragraph 1.E.1 requires the use of treatment works, materials management plans, ... and inspections as "the Department determines necessary to ensure that the discharge does not contravene" the ground water quality standards. We request that this paragraph be reworded to be consistent with N.J.A.C. 7:14A-7.6c which requires the use of treatment works, materials management plans, ... and inspections as "required to prevent contravention of" the ground water quality standards. This wording was proposed in comments and incorporated into the current NJPDES regulations in response to the comment (Cite 29 N.J.R. 1789, Comment 7-57).

Comment 6. Paragraph 1.H requires the GWPP plan to include a Maintenance, Inspection and Emergency Operating Manual (or manuals) for the regulated units. Although we maintain manuals in accordance with the regulations, the manuals are not included as part of the GWPP plan. Further, this paragraph is unnecessary since Section C, Paragraph 1 covers requirements for manuals in more detail. As such, we request that this paragraph be deleted or reworded to recognize that manuals can be stand-alone documents separate from the GWPP plan. This would also prevent the potential need to include copies of all operating and emergency manuals with the submittal of any GWPP plan (which would also exceed regulatory requirements for the submittal of manuals at N.J.A.C. 7:14A-6.12).

Section C: Additional Requirements

Comment 7. Paragraph 1 requires the submission of written verification that operation and maintenance manuals have been completed for the regulated units. Please note that we have previously mailed a letter to the Department dated May 12, 1997 stating that operation and maintenance manuals are in place for the facilities regulated by this NJPDES-DGW permit.

Comment 8. Paragraph 1.B requires records of maintenance and inspection required by the permit to be kept. We request that this requirement be clarified to exclude maintenance and inspection activities outlined in the operation and maintenance manuals. Most of the requirements in manuals are routine activities that are not generally documented in records, except possibly on an exception basis. These include routine preventive maintenance activities and inspections of facilities. The requirement to document each maintenance and inspection activity conducted by personnel in accordance with the manuals would be unduly burdensome and would result in considerably more time spent documenting activities, leaving far less time to conduct activities.

Comment 9. Paragraph 1.E.2. requires a schedule of maintenance and inspections of the processes including the "pollutant generation", conveyance, and discharge unit(s). We object to the inclusion of requirements for maintenance and inspection of pollutant generation processes within a NJPDES permit and request that "pollutant generation" be deleted from this requirement. The Bayway Refinery is the largest refinery on the East Coast. Including maintenance and inspection requirements for the entire refinery within the NJPDES permits is an extraordinarily burdensome and unnecessary task. Furthermore, there is no regulatory basis to include permit requirements on facilities that are not permitted by the NJDPES permit, such as refinery process units. N.J.A.C. 7:14A-6.12c specifically limits the requirements for operation and maintenance requirements to "treatment works, including related appurtenances and collection system".

Section D: Monitoring and Reporting Requirements

Comment 10. Paragraph 1.F requires the submission of a sampling plan within 30 days of a written request from the Department. Please note that sampling and analysis plans were already submitted to the Department as part of our approved GWPP Plan.

Part III: Special Conditions
Section A: Contingency Requirements

E&O Manual
Comment 11. Paragraph B establishes six requirements applicable whether a regulated unit is returned to service after an extended outage period; an unpermitted discharge occurs; or a disposal area fails hydraulically. We request that this paragraph be qualified with the wording "as appropriate", or similar wording, since all six requirements will likely not be applicable in every case. For example, Item 3 requires the Bureau of Engineering to be contacted to see if a TWA is needed to repair a failing unit. This would be unnecessary if an unpermitted discharge occurred due to something other than a failing unit (e.g., an upset condition that exceeded the design capacity of the unit).

Comment 12. Paragraph B.3 requires the Bureau of Engineering to be contacted to determine if a TWA is required prior to repairing a regulated unit. We request that this requirement be deleted since it appears to exceed current NJPDES requirements. A TWA is specifically required by N.J.A.C. 7:14A-22.3 for "building, installing, modifying or operating" only. Prior regulations requiring a TWA for repairs have been deleted from the NJPDES regulations because they were unnecessary and overly burdensome to both the Department and permittees.

Comment 13. Paragraph B.4 requires a TWA to be obtained for a new or altered regulated unit. We request that this requirement be qualified with wording such as "if needed" since there are exceptions to the need for a TWA at N.J.A.C. 7:14A-22.4.

<u>Secton B: Compliance with Other Rules</u>

Comment 14. Paragraph 2 requires a TWA for new construction, expansion or major "repairs". We request that "repairs" be replaced with "modifications" to be consistent with the NJPDES regulations, which require a TWA for modifications but not repairs.

<u>Section E: Additional Conditions</u>

Comment 15. The Operator Certification Paragraph requires the submission of operator names to the Department. Please note that all of the facilities covered by the NJPDES permit are currently operating and that operator names have previously been submitted to the Department as required.

Bayway Refining Company
a subsidiary of Tosco Corporation
1400 Park Avenue
Linden, New Jersey 07036

CERTIFIED MAIL – RRR
#Z 453 166 418

August 18, 1999

Change in Operator
NJPDES Permit Nos. NJ0001511,
NJ0026662, NJ 0026671, NJ0105104,
NJ0054348, NJ0087653 & NJ0087726

Dennis Hart, Director
NJDEP - Division of Water Quality
PO Box 029
Trenton, NJ 08625-0029

Dear Mr. Hart:

In accordance with N.J.A.C. 7:14A-16.2(d), this correspondence serves as notice of a change in operator at the Bayway Refinery site from Bayway Refining Company to Tosco Refining LP in Linden, New Jersey, for the following NJPDES permits:

- NJ0001511 (DSW), which permits surface water discharges;
- NJ0026662 and NJ0026671 (DSW), which permit stormwater discharges;
- NJ0054348, NJ0087653, NJ0087726 and NJ0105104 (DGW), which permit ground water discharges.

The change in operator will become effective September 1, 1999. There is no change to the owner or principal officer under these permits as a result of the change in operator from Bayway Refining Company to Tosco Refining LP. There is also no change to the other co-permittees presently listed for Permit No. NJ0001511. As such, we trust that this letter and the attached, completed forms for each permit serve as sufficient notification for the Department.

Please contact Mr. George Bakun at (908) 523-5896 if there are any questions.

Certification

I certify under penalty of law that this document and all attachments were prepared under my direction or supervision in accordance with a system designed to assure that qualified personnel properly gather and evaluate the information submitted. Based on my inquiry of the person or persons who manage the system, or those persons directly responsible for gathering the information, the information submitted is, to the best of my knowledge and belief, true, accurate, and complete. I am aware that there are significant penalties for submitting false information, including the possibility of fine and imprisonment for purposely, knowingly, recklessly or negligently submitting false information.

Very truly yours,

Herman L Seedorf III

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c: B. Chalofsky, NJDEP
D. Hammond, NJDEP
T. Huber, NJDEP
M. Miller, NJDEP
J. Roe, NJDEP
R. Shah, NJDEP
M. Wilusz, NJDEP

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